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USSR Report

ECONOMIC AFFAIRS

No. 927

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ECONOMIC POLICY, ORGANIZATION, AND MANAGEMENT

OLYMPIC OFFICIAL ON INFRASTRUCTURE OF 1980 OLYMPICS

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO)
in Russian No 2, Feb 80 pp 172-178

[Article by V. I. Koval', vice-president, Organizing Committee of the 22d Olympic Games: "Infrastructure of the 1980 Olympics]

[Text]

What is economically intimidating about the economics of the games?

The cost of organizing the games increases with the increase in their scale. But are they becoming unprofitable to the organizing country? This is not a simple question. The economic aspects have indeed begun playing an immense role in the modern Olympics movement. The costs in London, Helsinki and Melbourne amounted to several million dollars. The costs in Rome ran to the tens of millions. After Tokyo came Mexico City and Munich where the costs were reckoned in the hundreds of millions of dollars. In Montreal, the costs took a sharp jump and went far beyond a billion dollars.

The revenues of the Olympics (or more precisely the Organizing Committees) grow at a significantly slower pace than costs. In London, the revenues amounted to $3.1 million and exceeded costs by $0.4 million; there has not been such a favorable ratio since then. In Helsinki, Melbourne and Rome, the revenues did not exceed $5-7 million. This meant an approximately $1 million deficit for Helsinki and Melbourne and a $56 million deficit in Rome.

The deficit subsequently increased and reached the $1 billion mark in Montreal. According to the economic estimates, these games were the most unprofitable in the entire history of the Olympics.

But is this really the case? Let us take a closer look at these figures.

While the cost of organizing the games has remained structurally stable in recent years, the cost of creating the material-technical base depends on many factors. They depend first and foremost on the availability of large sports facilities in the city holding the games and on the level of development of the infrastructure. In the overall volume of costs, the cost of developing the infrastructure proves to be very high. Thus, Tokyo spent approximately $25.5 million on holding the games, $460 million on sports facilities and equipment, and more than $2.7 billion on the development and improvement of the infrastructure. As we see, 4-6 times more is spent on the development of the infrastructure than on the material-technical base of the games proper and on organization.

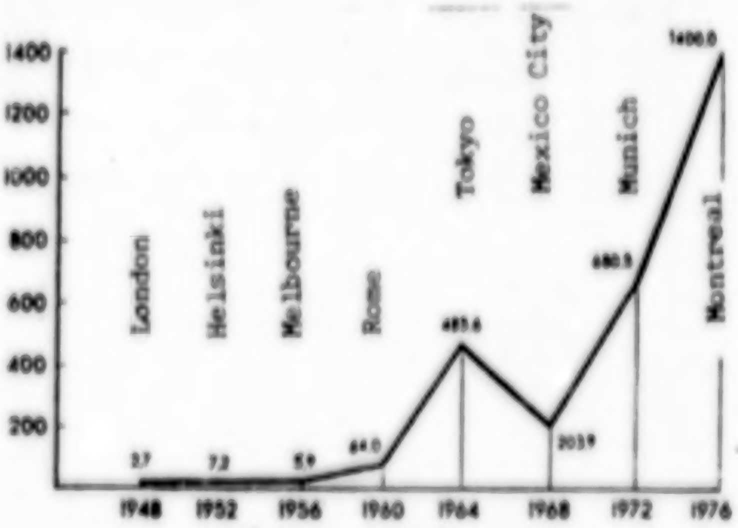
What generates the rumors that the games are unprofitable? What is it that economically intimidates organizers of the games? It is not the organizing costs: they are usually small and sucessfully defrayed by the revenues of the Organizing Committee. The fundamental issue is expenditures on the infrastructure. But investments in the development of the infrastructure (reconstruction of airports, construction of hotels, development of the system of communications and television) cannot be part of the total costs associated with the preparation of the games. Since all these facilities will be used after the games it would be incorrect to impute these costs exclusively to the Olympics. It could even be said that while the Olympics actively participate in [the construction of] the facilities, they in actuality only lease them from the city for less than three weeks. As regards the reconstruction of the sports base proper, it ultimately significantly improves sport activities.

Thus, expenditures on the infrastructure cannot be included in the cost of the Olympic games proper. They are usually included by mistake, due to ignorance, or for advertising purposes. Let us examine the data for Tokyo. It is true that the Organizing Committee did not include in its costs ($25.5 million) the considerably larger sum of $460 million spent on the creation of the material-technical base of the Olympics. A glib journalist wishing to frighten the man in the street with the enormity of the games' costs will cite the expenditures on the infrastructure. If he wants to gladden the latter's heart, he will reduce all expenditures to the actual organization of the games. Some members of the Munich and Montreal Organizing Committees accomodated this style of journalism by including the cost of building roads, viaducts, parking lots, garages, and other expenditures characteristic of the infrastructure in the cost of creating the material-technical base of the Olympics. While we must see the difficulties that are involved in the organization of the Olympic games, we must see the real difficulties instead of engaging in self-intimidation and self-advertising.

Expenditures and Revenues of the Olympics

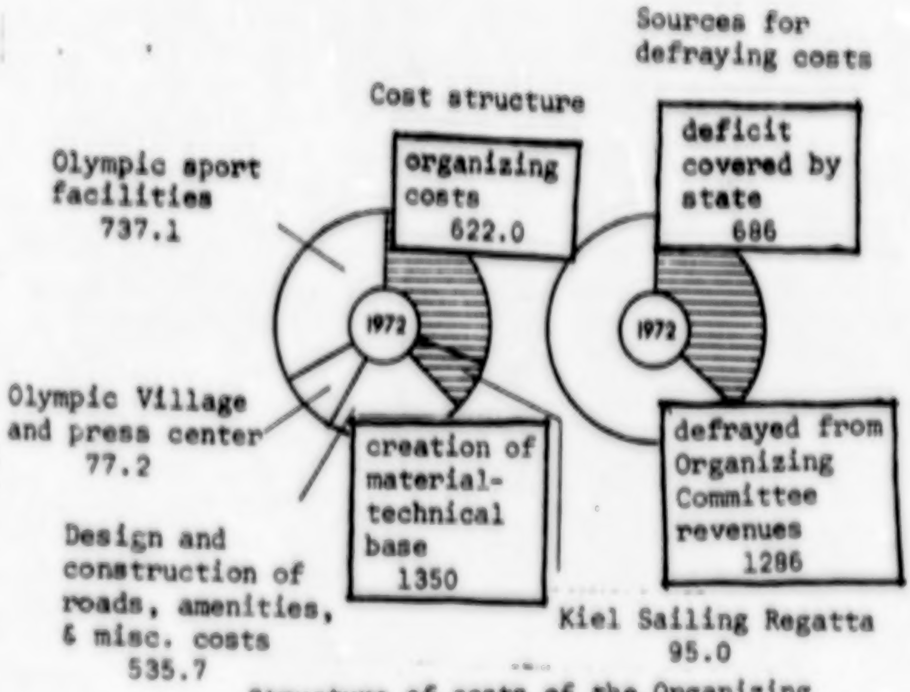
In 1972, a year after we for the first time requested that the games be held in Moscow, a delegation of the USSR Sports Committee visited the Federal Republic of Germany for the purpose of studying the organization of the games. We studied the construction of Olympic facilities, preparations for the games in Munich and Kiel, information and advertising, the organization of tourism, ticket sales, lotteries, and the preparation of cultural programs.

Munich's Oberbuergermeister Vogel, who subsequently became a minister in the FRG government, related many interesting things to me. The city indeed won a great deal from its preparations for the Olympics: it gained a modern transportation system including a subway system that was built in half the usual time -- a mere seven years. The city was the beneficiary of all sports facilities, of the apartments of the Olympic village, and the press center. And we ourselves witnessed the painting and repairing of building exteriors and the construction of new highways. Munich's main street, ordinarily packed with streetcars and motor vehicles, was transformed into a spacious pedestrian mall. A shopping mall complete with stores, cafeterias, barber shops, bookstores, fruit stands, and travel agencies was built beneath the vast Karlplatz Square.



Expenditures of Olympic Organizing Committees (millions of dollars)

By that time, the contours of the economic program of the 1972 Olympics would seem to have been clear. All economic projects (lotteries, coin sales, etc.) had been carried out successfully. On 1 February 1971, the Organizing Committee had already realized more than one billion marks from its economic program which was for the most part beamed at German-speaking countries (FRG, Austria, Switzerland). But the Germans were reluctant to advertise their economic program. They justified their pessimism with figures: at that time, expenses associated with the preparation of the games exceeded the Organizing Committee's revenues by 847 million marks. They did not say that the Organizing Committee would finance the preparation and conduct of the games from its own funds. To the contrary, on every occasion they emphasized that Munich and Kiel, the Bavarian government, and finally the federal government would participate in the preparation and financing of the games. In this stage, the discrepancy between expenditures and revenues was defrayed by state credits.



Structure of costs of the Organizing Committee of the 20th Olympic Games and Sources for Defraying Them

The organization of the Munich games cost a total of 1972 million marks. The revenues of the Organizing Committee (1286 million marks) met only 65.2 percent of total expenditures. The Organizing Committee's final deficit was 686 million marks. Half of this amount was covered by the federal budget and the other half was covered by the budget of the various Laender and cities. Expenditures on the creation of the material-technical base were two times higher than the cost of preparing and conducting the Munich games. This fact has been characteristic of all preceding and especially subsequent games.

The Olympic games are a costly, economically exceptional measure and one cannot seriously expect the entire complex of measures to pay for themselves precisely by the concluding day of the games. It would be a mistake to view all expenditures on the development of the infrastructure and on the creation of the material base of the Olympics as being exclusively associated with the Olympic games during those 16 fabulous days. The stadiums, the roads, the hotels, the buildings -- everything that we build for the Moscow games -- will also be useful after the Olympics, will be operated for many years to come.

The Long-Run Gain

By the time the 1980 Olympics begin, approximately 80 major sports, housing and cultural facilities will have been built and reconstructed in our homeland's capital city alone. Among them: the Central Stadium imeni

V. I. Lenin (the reconstruction of large and small sports arenas), a sports palace and swimming pool, an Olympic village, an international youth Olympics camp in the environs of Moscow, the Olympics ASU building, a new television and radio complex in Ostankino, the main press center, an equestrian sports base in Bittsevo, the "Dinamo" Stadium (general reconstruction), the "Dinamo" firing range in Mytishchi, the Central Tourist Home on Leninskiy Prospekt, the hotel complex in Izmaylovo, the international trade center on the Krasnopresnenskaya Quay, the new international post office, etc.

Everything -- metal, technology, architectural techniques -- is new on the Olympic construction projects. All of them are of exceptionally high quality and are built on an extremely tight schedule. The covered Olympic Stadium on Prospekt Mira covers three hectares; another 6.4 hectares are taken up with the podium connecting it to the swimming pool. The floor of an arena 127 meters long and 91 meters wide can be covered with synthetic carpeting, can be covered with recortane running track, or can be turned into an 8000 square-meter hockey rink. The arena can be divided in two by a soundproof corrugated steel curtain that extends to the roof and can be moved by special mechanisms.

The Olympic cycle track in Krylatskoye is a unique engineering facility that can compete with the best in the world (Rome, Montreal). Two gigantic wings 25 meters high cover an oval dish and are based on only four supports, each pair of which is 168 meters distant from the other. There is not a single intermediate support. The complex-geometry track is 333.3 meters long and 9 meters wide. It is to be covered with the best varieties of Siberian larch thereby making it possible for cyclists to make 42° turns at a speed of 90 kilometers an hour. The area within the track will be covered with artificial turf.

The infrastructural expenditures of the Olympics are earmarked for the creation of fixed capital -- roads, viaducts, television and hotel centers, and sports complexes with a service life that is counted in decades (the amortization of stadiums takes at least decades). It should be emphasized in particular that the construction and reconstruction of sports facilities and the preparation and conduct of the Olympic games do not in the least affect the rate of construction of housing and sociocultural facilities in Moscow and in other cities of the country. Housing construction in our country will continue at the previous rapid rate: Moscow will receive 21.6 million square meters in the Tenth Five-Year Plan alone.

What do the Olympic games offer the host country? First and foremost, they promote the general development of a number of branches of production. Second, there is a considerable increase in trade. Third, there is a sharp increase in the influx of tourists. It is estimated that tourism during the Montreal games brought approximately $300 million into Canada. Fourth, there is an increase in the influx of foreign currency (thus it is estimated that currency exchange by tourists gave the Canadian treasury over $500 million). Fifth, the volume of transport grows. Sixth, (this factor is important only for capitalist countries), there is a reduction in unemployment and in unemployment compensation by the state (hidden income resulting from increased employment of Canada's work force amounted to approximately $200-300 million). Dr. M. Hudson, a Canadian economist, analyzed the results of the Montreal Olympics as follows: "In any even, no matter what the gain (and the total sum cannot be measured precisely), one thing is clear: we conclude that the Olympic games can add at least $2.2 billion to the nation's economy."

Olympic Plans Become State Plans

The Olympic village has long been an international symbol of the games. Seldom does anyone recall that the very idea of such a village originated within the structure of the Olympics for very mercantile considerations. It was the year 1932. Los Angeles was preparing for the Tenth Olympic Games. Owing to the high cost of travel and hotel accomodations, the organizers built a real one-story village near the Olympic stadium. The village consisted of 700 two-room cottages, several dining halls, a hospital, and several service facilities. Since that time, the Olympic village has been an integral part of the Olympic games in the host country.

The host city of the Olympic games must not only build an Olympic village to house the athletes according to the terms of the IOC charter, must not only build well-equipped, modern sports facilities in which the athletes will compete, but must also have a developed infrastructure: a system of roads, terminals, and airports; a sufficient number of hotels and campgrounds for tourists; good communication lines; highly developed television and radio broadcasting systems; excellent energy and water supply facilities; and modern amenities. At the Olympics, everything must function perfectly. Comfortable conditions must be created for the activity and recreation of athletes, official visitors, journalists, service personnel, and for the millions of tourists. Thus there are two major tasks confronting the host country that would conduct the Olympic games at a modern scientific and technical level: (a) the task of conducting the games as a distinguished atheletic undertaking; and (b) the task of providing a developed urban infrastructure.

The creation and improvement of a developed urban infrastructure and the creation of the material-technical base of the Olympics require the investment of considerable sums already in the initial period of functioning of the Organizing Committee at a time when it does not yet possess large financial resources. Since in a capitalist economy, the municipal budget cannot provide sufficient sums to prepare the city for the games, it is necessary to make use of money from state and federal budgets and to float loans. Thus, the state budget financed the entire cost of building, reconstructing and outfitting sports facilities in Tokyo. In Munich, state sources covered only the deficit (the excess of expenditures over revenues). The situation was similar in Montreal where the financing of the organization of the games occasionally became so critical that the world press seriously questioned whether the Olympic games would be held there at all (there was a time when the Canadian government refused to underwrite the games).

The preparation and conduct of the Olympic games in a socialist country are naturally free to a considerable degree of the economic problems that existed previously. In a socialist economy, the state defrays the costs associated with the development of the city's infrastructure and with the creation of the material-technical base for the games. State planning organizations have included these organizational and economic aspects of the Olympic games in the overall plan for the development and reconstruction of Moscow and have designated the state budget as the main source of financing. All major material-technical expenditures associated with the preparation and conduct of the 1980 Olympics were provided for in the Tenth Five-Year Plan for the Development of the USSR National Economy Between 1976 and 1980.

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UTILIZATION OF RESOURCES AND SUPPLY

METAL STOCKS, NATIONAL WEALTH OF USSR, USA COMPARED

Moscow IZVESTIYA AKADEMII NAUK SSSR-SERIYA EKONOMICHESKAYA in Russian No 1, Jan-Feb 80 pp 107-116

[Article by L. L. Zusman: "The Problem of Structure of Metal Stocks and National Wealth of the USSR and the United States"]

[Text] This article makes an attempt to give a comparative analysis of the approximate sectorial structure of the national wealth of the USSR and the United States and of their differences on the basis of the data on the metal intensiveness of various sectors of the USSR industry and their correction with due regard for the differences between the structure of the national wealth of the United States and the USSR. The characteristics of utilization of the fixed productive capital of the USSR and the United States are examined.

The concept of national wealth is not generally recognized among Soviet economists. The main disagreement is as follows: Should the structure of national wealth include all the types of minerals and plant resources explored and prepared for utilization, which are available on the country's territory, areas suitable for agricultural land and so forth? A broader concept of national wealth also includes the size of the able-bodied population, its educational and skill level and so forth.

Initially, the concept of national wealth expresses the economic nature of this category as wealth created and accumulated by social labor on the territory of a given country by a specific date in the form of fixed capital, circulating capital and household property of the population. This concept characterizes the reproducible part of national wealth. Since the level of productivity of social labor to a certain extent depends on the natural resources available in the country and on their quality and degree of utilization, to be sure, the latter also have an effect on the magnitude of the reproducible part of national wealth. To a certain extent the same also applies to the components of national wealth in its broad interpretation.

In practice, however, the inclusion of all types of utilized natural resources in the structure of national wealth causes great difficulties, because it is connected with the need for their cost evaluation in a comparable form with an evaluation of the reproducible part of this wealth. An evaluation of various elements additionally included in the concept of national wealth in its broad interpretation is all the more difficult.

The USSR Central Statistical Administration takes only the reproducible part of national wealth into account in its structure.

As is well known, in the United States there is no state recording of the value of fixed and circulating capital. Private investigations in this area differ in the use of various methods and contain contradictory evaluations. The most in-depth investigation, which was the first to present the dynamics of national wealth of the United States over a long period, was conducted by the American economist Raymond W. Goldsmith.[1] The method developed by R. Goldsmith is based on the summing up of the data on capital investments with a correction for depreciation allowances for recording the residual value of the elements of national wealth and change in prices during the past period. Goldsmith himself admits that the inaccuracy in his calculations can reach 20 percent. At the same time, this investigation is the only one that can give results to a certain extent comparable with an evaluation of the reproducible national wealth of the USSR. It should be kept in mind that fundamental differences remain between the methods of evaluation of the reproducible national wealth of the USSR and the United States. The fixed capital of the USSR is evaluated according to the full balance value, while the fixed capital of the United States, according to the residual value minus its assumed wear according to depreciation norms. The value of buildings and structures in the United States includes the "value" of the land area occupied by them. The household property of the USSR population encompasses movable property and of the U.S. population, only that with a life of no less than 2 to 3 years. Furthermore, the value of the household property of the U.S. population is calculated at the existing retail prices, that is, with an inclusion of the turnover tax, while in the United States this tax is almost completely absent in retail prices. There are also a number of smaller differences in the methods of determination of the reproducible national wealth of the USSR, which is based mainly on the system of state recording, and its approximate evaluation existing in the United States.

In order to make the volume and structure of the national wealth of the USSR and the United States sufficiently comparable, in addition to the noted differences it is also necessary to take into account the parity of the ruble and dollar as of the date under consideration as applied to fixed capital and the material part of circulating capital, as well as to the household property of the population.

The attempt made by us in this direction, with the inevitability of a number of conventional evaluations, led to the conclusion that as of the beginning of 1977 the volume of reproducible national wealth of the USSR approached one-half of the volume of reproducible wealth of the United States accumulated by that time. It should be noted that the volume of reproducible national wealth of the USSR in relation to the United States in 1914 was taken as 22.5 percent (within the borders of the Russian Empire) and 18.1 percent (within the borders of the USSR before 1940),[2] while the value of the fixed capital of the USSR in relation to the fixed capital of the United States at the beginning of 1960 was evaluated at 35 percent.[3] Since the fixed capital of the USSR (fixed capital of the United States) is the predominant part of the volume of national wealth, their comparison as of the beginning of 1960 reflects the relationship between the national wealth of the USSR and the United States quite accurately. This gives reason to conclude that during 1961-1976 the increase in the national wealth of the USSR exceeded the increase in the national wealth of the United States during that period approximately 1.4-fold.

National wealth is a synthetic indicator of national economic development. However, an investigation of national wealth from this aspect is possible only as a result of its "anatomical incision," primarily an analysis of its sectorial structure.

The differences in the sectorial structure of the national wealth of the USSR and the United States can be very clearly detected on the basis of a comparison of the structure of the metal stocks of these countries with due regard for the indices of metal intensiveness (in thousands tons of metal weight per billion of the value of fixed capital) throughout national economic sectors.

Metal as the material basis for various types of fixed capital is accumulated in machinery, equipment, buildings, structures and other types of fixed capital, in circulating capital (in semifinished products and incomplete production in metallurgical and metal consuming sectors, in finished articles at the warehouse, in spare parts and so forth) and in the population's household articles.

Metal with a calculated average life (with due regard for its replacement in the process of capital and current repairs) of 13 years[4] forms the basic part of the country's metal stocks. The remaining part (about 11 to 12 percent) consists of metal in circulating capital.

The total volume of the country's metal stocks is calculated by the method of metal investments. The import of metal products is added to the volume of smelting of virgin metal (cast iron) and their export, as well as irrevocable metal losses in the form of metal waste and parts of metal that has fallen into disuse as a result of the end of its life, wear and corrosion, is deducted. The total volume of the country's metal stocks serves as a control indicator when the sectorial structure of metal stocks is determined.

The sectorial and specific structures of the metal stocks of the USSR were investigated in detail as of 1 January 1960 and 1 January 1972. The methodology of these investigations in the USSR is generally known.[5]

The total volume and sectorial structure of the metal stocks of the United States as of 1 January 1972 were also investigated in detail. The methodology of this investigation does not differ fundamentally from the methodology of investigation of the metal stocks of the USSR. However, owing to the differences in the initial data, the calculations for individual sectors of the United States were not performed with the same accuracy. For example, on the basis of the published detailed data on the pool of trucks and passenger cars in the United States and on the models and weight of metal in each of them the weight of articles made of ferrous metal in the motor transport of the United States was calculated most accurately. The same applies to railroad transport, main transport railway tracks and pipeline and maritime transport in the United States. The metal stocks of agriculture of the United States were calculated on the basis of the available detailed data on the pool of utilized agricultural machines and their specifications, an evaluation of the weight of metal in each kind and type of machine and the available data on trucks and their differentiated carrying capacity used in U.S. agriculture.

Control calculations were also performed in the process of investigation. They made it possible to become convinced of the sufficient reliability of the final data obtained by means of direct calculations. As a rule, such control calculations were performed on the basis of the data of the American Institute of Iron and Steel on the deliveries of steel products to various sectors of machine building and to construction. At the same time, the coefficient of output of articles suitable for metalworking differentiated by sectors, as well as the average life of various types of metal articles, was calculated.[6] The control calculation of the volume of metal stocks of the United States calculated by the method of metal investments showed that, as compared with the volume of the same fund calculated in terms of sectors, it was 6 percent higher. This difference can be explained by the incomplete recording of military property and the approximate nature of the recording of irrevocable metal losses when the method of metal investments is used. A similar difference as applied to the metal stocks of the USSR as of 1 January 1972 comprised about 10 percent. Therefore, it can be assumed that the degree of reliability of the calculated sectorial structure of the metal stocks of the United States is close to a similar calculation for the USSR.

The obtained structures of the metal stocks of the USSR and the United States as of 1 January 1972 were then corrected as of the beginning of 1975 (percent):[7] /See following page/

An investigation of the structure of the metal stocks of the USSR as of 1 January 1972 disclosed that the weight of articles made of ferrous metal (ton) per million ruble of the value of fixed capital (according to its reevaluation on this date) was (in relation to the metal intensiveness of industry equal to 1) 0.443 in agriculture, 1.190 in transport, 0.367 in communication, 1.090 in the construction industry, 0.539 in trade, public dining, material and technical supply and sales and procurements, 0.260 in housing services, 0.475 in municipal and domestic services for the public, 0.440 in public health and 0.320 in education.

	USSR	USA
Industry	36.5	27.8
Construction	3.4	1.7
Transport	17.0	21.9
Communication	0.4	0.4
Agriculture	6.4	5.2
Trade, public dining, procurements, material and technical supply and other material production sectors	2.3	4.3
Total in material production sectors	66.0	61.3
Housing services	7.5	7.7
Municipal and domestic services for the public	2.0	1.8
Public health	0.9	0.3
Education	1.1	0.8
Total in nonproduction sectors	11.5	10.6
Household property of the population	1.9	11.7
including passenger cars	0.3	5.5
Metal in circulating capital	10.6	10.4
Metal in unaccounted for capital and lack of coordination with the total volume of metal stocks calculated by the method of metal investments	10.0	6.0
Total	100.0	100.0

The presented structure of the metal stocks of the United States makes it possible to get an approximate idea of the sectorial structure of the reproducible national wealth of this country.

To refine the structure of the reproducible national wealth of the United States, it is necessary to take into account certain differences in the structure of individual sectors of the United States. First, this applies to public transportation, whose intrasectorial structure differs considerably from a similar structure in the USSR. For example, whereas in the USSR in 1977 the proportion of railroad transport in the total volume of freight turnover made up 59.1 percent and the proportion of motor transport, 6.6 percent, in the United States, 27.4 and 20.2 percent respectively (1975). The proportion of these types of transport in passenger turnover made up 40.1 and 42.4 percent respectively in the USSR (including public buses) and 1 and 99 percent, in the United States. The proportion of metal intensiveness of the fixed capital of motor transport without taking superhighways into consideration is several times (of freight transport, three to four times and of passenger transport, seven to eight times) lower as compared with railroad transport.

With due regard for the superhighways servicing public transportation, this difference in the proportion of metal intensiveness is reduced, but still remains significant. Therefore, the index of metal intensiveness in U.S. transport is taken as 1.00 in relation to the index of metal intensiveness in industry (in the USSR, 1.190); in agriculture, owing to its higher provision with machinery and electric power, 0.600 (in the USSR, 0.443).

Owing to the fact that the proportion of group "A" in the industry of the United States is estimated at 65 percent instead of 74 percent in the USSR,[8] the index of metal intensiveness in the industry of the United States is taken as 0.90 (in the USSR, 1.0). All the indices of metal intensiveness in the other national economic sectors of the United States in relation to the corrected index of industry are recalculated respectively.

The performed investigation makes it possible to tentatively describe the differences in the structure of the national wealth of the USSR and the United States represented in fixed capital.

Structure of the National Wealth of the USSR and the United States in Fixed Capital as of the Beginning of 1976, %

	USSR	USA (tentative evaluation)
Productive fixed capital	64.6	63.1
including:		
of industry	30.9	25.5
of agriculture	13.4	9.0
of transport and communication (including roads)	13.5	20.0
of construction	2.9	1.4
of trade, public dining, procurements, material and technical supply and sales and other material production sectors	3.9	7.2
Nonproductive fixed capital	35.4	35.9
including:		
of housing services	20.8	27.8
of municipal and domestic services for the public	4.4	3.5
of public health and education	6.0	3.1
of science, culture, art and other nonproductive sectors	4.2	2.5
Total	100.0	100.0

At the same time, it should be taken into consideration, first, that the volume of reproducible national wealth of the USSR is approximately one-half the volume in the United States and, second, that the proportions of individual components of the structure are interconnected to a certain extent. For example, although the proportion of agriculture in the United States is one-third lower than in the USSR, taking into consideration that every percent in the structure of the national wealth of the United States in the absolute volume is approximately twice as high as in the USSR, the value of national wealth in the fixed capital of agriculture in the USSR as of the beginning of 1975 was approximately one-third lower than in the United States. Furthermore, the infrastructure of transport, communication, trade and material supply has an effect on a reduction in the proportion of agriculture in the national wealth of the United States. When comparing the proportion of USSR and U.S. agriculture in the total volume of metal stocks and national wealth, it should be taken into consideration that American statistics does not include in the structure of agricultural operations many types of operations performed by kolkhozes and sovkhozes in the USSR, that is, repair of machinery, equipment and structures, partial preparation of feed for livestock, preparation and application of fertilizers to arable land, delivery of means of production to farms, transport of agricultural products to receiving centers and so forth. This to some extent underestimated the proportion of U.S. agriculture in the total volume of metal stocks and national wealth.

The fixed capital of the USSR (fixed capital of the United States) in material production sectors (without the infrastructure) makes up 47.2 percent of its total value in the USSR, 35.9 percent, in the United States and 17.4 and 27.2 percent respectively in the sectors of the material infrastructure. The proportion of transport and communication in the fixed productive capital of the USSR is 13.5 percent and in the fixed capital of the United States, 20.0 percent (with due regard for the value of the pool of public passenger cars). In particular, this significant difference is affected by the value of motor roads, whose length exceeds 6 million km in the United States (233.4 billion dollars--at the prices of 1967--were invested in their construction during 1900-1971), the excessive length of railroad tracks belonging to rival companies (as of 1 January 1978) amounting to 319,000 km[9] and the vast pool of motor vehicles, which at the beginning of 1976 reached 130.8 million units, including 105.3 million passenger cars, among them 25.5 million motor vehicles for individual use, trucks and buses.[10] On the basis of the general difference in the volume of national wealth the absolute value of fixed capital of the USSR industry comprises about two-thirds of the value of similar capital of the United States. At the same time, the sectorial structure of the U.S. industry differs from a similar structure in the United States in a higher proportion of industrial sectors and subsectors. For example, the fixed capital of the sectors for the extraction of fuel, iron, manganese and chrome ores, nonferrous metal ores and nonore minerals for the chemical and building materials industries and of the appropriate concentrating factories makes up about 16 percent in the total value of the fixed capital of industry[11] and in the United States, 3.4 percent. The low proportion of extractive sectors in the fixed capital of the United States is due to the import nature of most types of raw materials and fuel consumed in the U.S. industry, as well as to the tendency to use the rich resources and cheap manpower of economically less developed countries for the purpose of obtaining high profits.

The higher proportion of the sectors of trade, public dining and material and technical supply in the national wealth of the United States is due to the specific conditions of competition in the capitalist economy, which presuppose the creation of excess capacities.

With the same, according to the evaluations of the USSR Central Statistical Administration, volume of capital construction in the USSR and the United States[12] the proportion of the fixed capital of the construction industry in the national wealth of the USSR more than twice exceeds this proportion in the national wealth of the United States. To a certain extent this is due to the longer periods of capital construction of similar projects in the USSR, which lead to the freezing of some construction equipment.

The housing services of the United States in their absolute volume are approximately twice as high as in the USSR. Their proportion in the total national wealth is somewhat higher. However, the proportion of municipal and domestic services for the public in national wealth is much higher in the USSR than in the United States. The economic crisis of American cities has intensified in the United States in the last few years, which is reflected in the state and development of municipal services. In the USSR, however, the development of the latter is furthered by extensive urban construction with all types of civic improvements. The proportion of sectors holding an important place in the public consumption fund (public health and education) in the national wealth of the USSR is twice as high as in the United States. The same applies to the sectors of science, culture and art. The different social direction of the formation of national wealth in the USSR and the United States is expressed in this.

The national economy of the USSR, which develops in a planned and proportionate manner, has as its basic social task the steady rise of the people's material and cultural standard of living and differs fundamentally in this from the spontaneous, under the conditions of private ownership of means of production, development of the U.S. economy, whose object is to derive the maximum profit.

The dissimilar degree of utilization of the fixed capital of the USSR and the United States is also due to these differences.

The fuller utilization of the fixed productive capital of the USSR is illustrated by the following facts. With the value of fixed productive capital of the USSR industry equal to approximately two-thirds of the value of fixed capital of the United States, according to an evaluation by the USSR Central Statistical Administration, the volume of industrial output in the USSR makes up about 80 percent of that in the United States. As indicated in the report of the Soviet commission, which inspected metallurgical plants in the United States in 1974, the utilization of the useful volume of blast furnaces in the United States is almost one-half lower than in the USSR.[13] The unutilized capacities of the petroleum extracting industry of the United States totaled 50 million tons in 1960 and 190 million tons in 1965. In the United States in 1969 there were 1,100,000 abandoned wells, including hundreds of thousands of operating wells, which were closed temporarily.[14] Even during the present period of the energy crisis experienced in the United States petroleum monopolies restrict the utilization of the full capacity of existing wells in order to raise the prices of petroleum and the products of its refining. The level of utilization of production capacities in sectors with a continuous production cycle is much lower in the United States. In the metalworking and machine building industries the work shift coefficient in the USSR and the United States, on the average, is almost the same, although it is due to different social and economic reasons: in the USSR, to the planned correlation of the development of ferrous metallurgy and machine building and to the partially incomplete provision of metalworking and machine building with labor resources in connection with the demographic situation; in the United States, to the unstable need for machine building output throughout the economic cycle and to the creation of excess capacity in metalworking and machine building under the conditions of the competitive fight for the sales market. The same also applies to other sectors of the U.S. industry with an interrupted production cycle. The level of utilization of production capacity throughout the U.S. industry is evaluated as follows: 1971, 75.0 percent, 1972, 78.1 percent, 1973, 83.0 percent, 1974, 79.0 percent, 1975, 68.7 percent, 1976, 80.2 percent and 1977, 82.6 percent.[15]

At the same time, the concept of "capacity," on which the indices of the U.S. Bureau of the National Industrial Conference are based, corresponds to the actual maximum capacity (load) of an enterprise, not to its technical capacity, as is accepted in the evaluation of the utilization of production capacities of industrial enterprises in the USSR. Therefore, the actual level of utilization of production capacity in the U.S. industry in a form comparable with the USSR is lower than the presented American generalized indices.

According to the evaluation of the Institute of Complex Transport Problems under the USSR State Planning Committee the utilization of the production capacity of various types of freight and passenger transport in the United States in 1960, on the average, made up 30 percent, including railroad transport, 43 percent, city and intercity motor transport, 21 percent, inland water transport, 57 percent, petroleum pipeline transport, 61 percent, gas pipeline transport, 78 percent and passenger transport, 44 percent, on the average.[16] By this time this level of capacity utilization has not changed much. As the calculations performed by us show, according to the weight of metal in the fixed capital of transport subsectors in relation to 1 billion tons of freight turnover in 1972 the volume of transport operations was higher in the USSR as compared with the United States as follows: by railroad transport, 4.0-fold; by overseas transport, 2.1 percent; by public motor freight transport, 1.9-fold; by petroleum pipeline transport, 29 percent; by gas pipeline transport, 11.2 percent. Only by river transport was it 40.0 percent lower, which is due to the shorter navigational period for river navigation in the USSR as compared with the United

States. On the whole, in all types of public transport the volume of freight turnover per million tons of metal in the fixed capital of transport in the USSR is twice as high as in the United States. This significant lag in the utilization of the capacities of the U.S. transport system, which occupies more than one-fifth in the country's fixed capital and more than one-third of the part of fixed productive capital, is the result of the clash between private capitalist and public interests. A considerable part of the capacity of railroad transport created in the past still remains, despite its displacement by advanced, new subsectors--motor and pipeline transport. In particular, the technical backwardness of the U.S. transport system is expressed in almost a complete absence of the most advanced type of railroad traction--electric locomotive traction--and in the predominant importance in pipeline transport of small-diameter pipes, which have not been replaced by modern large-diameter pipes forming the basis for the main pipeline transport of the USSR.

The use of small-diameter pipes in the pipeline transport of the United States is connected with the special conditions of the capitalist economy. The pipeline transport of the United States is characterized by a high degree of monopolization. Twenty major petroleum companies for the extraction and refining of petroleum hold the leading place in the petroleum pipeline transport of the United States. About 70 percent of the entire network of pipelines and almost 90 percent of their production capacities belong to them (or are controlled by them).

Petroleum pipelines are powerful tools of U.S. petroleum monopolies in the competitive fight for petroleum markets and for an expansion of the sale of petroleum and petroleum products. Small petroleum companies, which do not have their own pipelines, during the sale of petroleum must pay them for delivery at the high rates established by pipeline companies, or sell petroleum at the low f.o.b. well prices dictated by big petroleum companies.

Since a significant number of product lines are designed for the sale of the output of any one petroleum refining plant, the pipe diameter is not big. Approximately the same also applies to gas pipelines.

It can be assumed that the level of utilization of agricultural equipment, tractors and trucks in the agriculture of the USSR concentrated on 47,200 kolkhozes and sovkhozes (1977) is higher than their utilization in the agriculture of the United States scattered on almost 3 million farms, especially as, owing to the different harvest periods in different regions of the USSR, agricultural equipment, tractors and trucks are transferred from one region to another for temporary use.

Thus, socialism creates conditions for a fuller utilization of the country's productive fixed capital as compared with the capitalist system prevalent in the United States.

To a certain extent this also applies to nonproductive fixed capital. For example, according to published data, in the United States in 1975 about 8 percent of the available apartments were not occupied owing to the high rent for reasons of racial discrimination and so forth.

Thus, the reproducible national wealth of the USSR is utilized more effectively as compared with the national wealth of the United States.

It does not at all follow from this that the created vast production potential of the USSR is utilized to the fullest extent. As L. I. Brezhnev pointed out in the accountability report to the 25th CPSU Congress, "owing to the incomplete utilization of production capacities, year after year we fail to obtain output worth many billions of rubles."[17] In this respect there are significant potentials, which should be utilized on the basis of an improvement in the intrasectorial and intraplant organization of production, intensification of the specialization and improvement of the cooperation of production and shortening of idle time for repair needs by increasing the durability and reliability of interchangeable parts and units of structures, mastering advanced technology and strengthening technological discipline.

The socialist economy, which develops in a planned and proportionate manner, does not eliminate the need for optimum sizes of reserve production capacities in all the sectors of material production and the infrastructure. This is an important condition for a prompt change in the assortment of output in accordance with the changed production need in the course of technical progress, the fullest utilization of the harvest of agricultural products, a fuller and prompt satisfaction of the domestic needs of the population and its requests for different characteristics of similar products and for their new kinds and improvement in the quality of output. Therefore, the existence of reserve production capacities in optimum sizes envisaged in the socialist economy, which develops in a planned and proportionate manner, is an important condition for increasing the efficiency of public production.

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REGIONAL DEVELOPMENT

REGIONAL PECULIARITIES IMPACTING ON PRODUCTION EFFICIENCY

Moscow IZVESTIYA AKADEMII NAUK SSSR-SERIYA EKONOMICHESKAYA in Russian No 2, Mar-Apr 80 pp 51-57

[Article by V. N. Shimov: "Regional Peculiarities in Determining the Economic Effectiveness of Social Production"]

[Text] The specifics of determining the regional economic effectiveness of social production are examined an indicators for evaluating effectiveness are proposed. Techniques used in the calculation of net output are investigated at the oblast level as a whole and in the basic branches of material production.

The 12 July 1979 decree of the CPSU Central Committee and the USSR Council of Ministers "On the Improvement of Planning and on Increasing the Influence of the Economic Mechanism on Enhancing the Production Efficiency and the Quality of Work" examined the various directions of further improvement of the economic mechanism and outlined a number of measures for maximizing the utilization of the economy's reserves under the conditions of developed socialism. The decree devoted substantial attention to improving the system of indicators used in evaluating the economic performance of enterprises, associations, ministries, and departments and in determining the economic effectiveness of social production. In this system of indicators, an important role is assigned to normative net output which is calculated as the sum of profits of enterprises in the sphere of material production, wages, and social insurance deductions.

Guidelines on the procedures for developing and applying the indicator of (normative) net output in planning (ratified on 12 September 1979 by USSR Gosplan, USSR Goskomtsen [State Committee on Prices], USSR Minfin [Ministry of Finance], and USSR Goskomtrud [State Committee for Labor and Social Problems]) articulate a uniform procedure for developing the indicator and for incorporating it in national economic planning practice.

The guidelines examining the calculation of normative net output solely at the level of industrial enterprises, associations, ministries, and departments. Thereby conditions are created for comparing indicators of the efficiency of industry and the effectiveness of the social production of the country and republics on the basis of national income (net output).

However, in national economic planning practice there is an urgent need to evaluate the regional efficiency of social production in regional material production as a whole.

Analysis of the literature on the effectiveness of social production indicates that at the present time the majority of economists construe the economic efficiency criterion to mean the maximization of the growth of national income (net output) vis-a-vis resources or outlays on production given the optimum correlation of consumption and accumulation funds.

When we examine the problem of determining the efficiency of social production at the level of economic regions, oblasts and ASSRs, we must first of all determine whether the efficiency criterion is uniform for the national economic and the regional level.

Since the regional economy is "open" and functions under the conditions of the intraregional and interregional division of labor and specialization, the formation of the most effective product mix is possible only from the standpoint of the national economy, i. e., top priority must be assigned to production facilities that are capable of maximum national economic effectiveness and of satisfying the population's requirements to the maximum degree.

The "open" character of the regional economy also leaves its imprint on the reproductive process. The net product produced in the various regions is not balanced with consumed national income. The economy of the regions of the given taxonomic rank is developed as a result of the distribution of the national income of the union republic and the nation in line with national economic interests based on the most rational utilization of local production resources. Given such a formulation of the question, the criterion of effectiveness will be uniform and the orientation of the economy of the various regions toward the maximization of net output per unit of production resources will result in maximum efficiency for the republic or country as a whole.

Recent years have seen the publication of a number of works (N. N. Nekrasov, M. V. Bakhrakh, V. M. Ryabtsov, Ye. D. Silayev, M. A. Sergeyev, A. I. Demin, and others) which basically examined the problem of determining regional economic effectiveness at the level of union republics and large economic regions. However, there is no consensus on the system of indicators that measure the regional effectiveness of production. Only a few works are devoted to the determination of the economic efficiency of production at the oblast level. This is evidence of the insufficient elaboration of this important problem and of the need for more attention to this important problem by scientific and practical workers.

The experience derived by the NIIEMP [expansion not given] under BSSR Gosplan in devising a program for the comprehensive development of the economy of the Gomel'skaya Oblast up to the year 200 shows that a system of interconnected indicators characterizing the degree of utilization of basic production resources on the one hand and the effectiveness of expenditures on production on the other can be used to determine the effectiveness of development of regional material production over time and for the selection and substantiation of the optimal variant.

First among them is the indicator of the efficiency of the use of live labor. Given the changing demographic situation at a time when the development of the economy in the next 10-15 years will be in the face of a declining influx of labor resources, the effective use of the latter becomes particularly urgent. Labor productivity can be used as an indicator of the absolute effectiveness of the utilization of live labor. However, labor productivity must be calculated on the basis of net rather than gross output. The techniques used in the calculation of net output in the complex of branches of material production at the oblast level will be examined a little later.

The output-capital ratio is the second major indicator characterizing regional economic efficiency. Given the continuous intensification of production, this indicator will acquire more and more significance. The growth of labor productivity under the conditions of developed socialism is possible only on the basis of the all-round mechanization and automation of production processes, which is associated with the constant growth of capital per worker and consequently with changing growth rates of the output-capital ratio. In certain stages of development of the productive forces, it is entirely possible that the growth rates of capital per worker will be higher than the growth rates of labor productivity and this can lead to a decline in the output-capital ratio and to an increase in the capital-output ratio. Thus, for example, between 1970 and 1977 the growth rate of labor productivity in USSR was 144 percent while capital per industrial production worker was 162 percent.[1]

The effectiveness of the utilization of material expenditures is the third indicator of regional economic efficiency of social production. At the same time, material inputs in addition to direct inputs (raw materials, supplies, auxiliary materials, fuel and energy) must include amortization allowances which are included in the production cost [sebestoimost'] of commercial products. The materials-output ratio is not presently calculated in most regional draft plans owing to the lack of ex post input-output tables at the oblast and ASSR level. However, the determination of the net product at the oblast (kray, ASSR) level in branch terms permits us to calculate the total volume of material inputs as the difference between the gross and net output of various branches.

Under the conditions of developed socialism, the problem of economizing on material inputs and of reducing the materials-output ratio is viewed as the most important direction in increasing the efficiency of social production.

This is an urgent problem because the share of material inputs in the productive inputs of many branches of the national economy is considerable. According to the data for 1976, direct material inputs amounted to 73.6 percent in the productive inputs of USSR industry alone while in a number of industrial branches they were considerably higher (89.4 percent in light industry; 88.7 percent in the food industry).[2]

The effectiveness of the utilization of the entire aggregate of productive inputs, which is determined as the ratio of the annual oblast net output volume to the annual volume of productive inputs is the fourth indicator.

The close interrelationship and interconditionality of these indicators and their economic content enable us to determine the optimal variant of regional economic development by comparing their absolute values and by analyzing their dynamics. When symbols are introduced, the given group of indicators assumes the form

$$\text{Э}_{\text{ж}} = \frac{\text{Ч}_{\text{п}}}{\text{Ч}_{\text{р}}};\ \text{Э}_{\text{о}} = \frac{\text{Ч}_{\text{п}}}{\text{Ф}};\ \text{Э}_{\text{мз}} = \frac{\text{Ч}_{\text{п}}}{\text{МЗ} + \text{А}};$$

$$\text{Э}_{\text{з}} = \frac{\text{Ч}_{\text{п}}}{\text{МЗ} + \text{А} + \text{ЗП} + \text{Пр}},$$

where $\text{Э}_{\text{ж}}$, $\text{Э}_{\text{о}}$, $\text{Э}_{\text{мз}}$, and $\text{Э}_{\text{з}}$ are the effectiveness of utilization of live labor, embodied labor, material inputs, and productive inputs, respectively, within the framework of the oblast; $\text{Ч}_{\text{п}}$ is oblast net output; $\text{Ч}_{\text{р}}$ is the average annual number of persons employed in branches of material production; Ф is average annual value of fixed productive capital; МЗ is direct material inputs; А is amortization allowances; Пр is miscellaneous inputs not distributed by elements; and ЗП is the annual volume of wages.

In our opinion, there is no justification for using a broader range of indicators to determine the regional economic effectiveness of social production at the oblast level (1) because this makes it difficult to compare indicators and (2) because other effectiveness indicators proposed in scientific literature are either of a particular nature or are derived from the indicated four.

Of all the indicators needed to determine the regional effectiveness of social production, it is most difficult to calculate net output on the basis of existing statistics. The material inputs indicator is a derivative of gross and net output. Accordingly, let us discuss the techniques used in the calculation of net output at the oblast level.

There are two possible techniques for calculating net output: the productive technique, recommended in Guidelines on the Elaboration of State Plans for the Development of the USSR National Economy, and the distributive technique, which acquired recognition in the recently promulgated decree of the CPSU Central Committee and the USSR Council of Ministers "On the Improvement of Planning and on Increasing the Influence of the Economic Mechanism on Enhancing the Production Efficiency and the Quality of Work."

The productive technique can be used to determine oblast net output as the difference between the value of the gross product of branches of material production and the quantity of material inputs:

$$Ч_н = \sum_{i=1}^{n} (В_i - МЗ_i),$$

where $Ч_n$ is the net product created in oblast material production; i (i = 1,......,n) is the number of branches of material production; $В_i$ is gross output of the i-th branch of material production; МЗ is material inputs of the i-th branch of material production. Obviously, $Ч_n \to$ max where $В_i$ and $i \to$ max and $МЗ_i \to$ min.

However, at the present time the absence of basic statistical information makes it difficult to use the productive technique to calculate net output at the oblast level. In particular, it is impossible to determine oblast net industrial output for an entire span of enterprises on the basis of the productive technique because Annual Report Form No 5 ("Production Inputs") is completed only by enterprises of union subordination. What is more, at the present time gross output at the oblast level is computed for only two branches of material production: industry and agriculture. Consequently, the application of the productive technique requires that the gross output of other branches of material production in an oblast be estimated.

From the standpoint of the availability of statistical information, it is more feasible to use the distributive technique to calculate oblast net output. This technique sums the primary income of enterprises in the material production sphere and the primary income of personnel, i. e.,

$$Ч_н = \sum_{i=1}^{n} (ЗП + П + НО + С),$$

where П is the profit of enterprises in branches of material production; ЗП is wages; НО is turnover tax created by all branches of material production within the oblast; С is social insurance charges; i(i=1,....,n) is the number of branches of material production.

Wages, the first component element of net output computed at the oblast level by the distributive technique, may be calculated for branches of the national economy on the basis of Table 7 of the USSR TsSU [Central Statistical Administration] Form "Wage, Bonus and Remuneration Fund, One-Time Rewards, Miscellaneous Monetary and In-Kind Payments to Workers and Employees in the Year...." The same table also contains data on social insurance charges. Wages must be calculated on the basis of the wage fund for scheduled and unscheduled personnel, on the basis of total payments from the material incentive fund, on the basis of one-time and other cash bonuses that are not part of the wage fund, and other monetary and in-kind payments to personnel. Agriculture in Table 7 is represented only by state and interfarm enterprises and hence the data in this table must be augmented by the wages of kolkhoz workers (Form No 5-skh of Kolkhoz Annual Reports).

The informational basis for the calculation of profit is TsSU Form No 5 ("Fulfillment of Profit Plan for Types of Economic Activity for Year...") which includes profit derived from all types of economic activity of enterprises and organizations in the sphere of material production (at the branch level). Data on kolkhoz profits are contained in the Kolkhoz Annual Reports (Form No 4-skh).

However, profit from sold products is shown in USSR TsSU Form No 5 and in Kolkhoz Annual Reports. In the calculation of net branch output, we are interested in all newly created value. Consequently, we must evaluate the conditional profit that kolkhozes (sovkhozes) would receive from the sale of their total output (marketability index = 1) or, to put it another way, the entire output volume must ve evaluated in sale prices.

In our opinion, it is not appropriate to equate gross income with net output as some researchers do.[3] Gross income calculated according to the TsSU methods and reflected in Kolkhoz Annual Reports represents the difference between gross output and material inputs. Gross output, which is the basis for calculating gross income, is evaluated on the basis of sale prices only for commercial products while noncommercial products are calculated on the basis of production cost. Consequently, the net product of kolkhozes can be arrived at by adding a conditional profit to gross income. Conditional profit can also supplement profit obtained on sovkhozes.

Conditional profit from the sale of noncommercial products can be calculated according to the formula

$$\Pi_{\text{ус}} = \text{B} + l\Pi_{\text{т}} - \text{T}(1 + l),$$

where B is the value of the gross product of crop production and animal husbandry in sale prices (calculated on the basis of sale prices in the volume of agricultural production); T is the value of commercial output in sale prices (Table No 4-skh, Column 13 of the Kolkhoz Annual Report); and $\Pi_{\text{т}}$ is the actual profit from products sold (Column 13 of Form No 4-skh).

$$l = \frac{\text{production cost of noncommercial products}}{\text{production cost of commercial products}};$$

the production cost of commercial products is determined on the basis of Column No 14 of Form No 4-skh; the production cost of noncommercial products equals the difference between the production cost of products produced (Form No 6-skh, III Annual Report) and the production cost of products sold.

In order to calculate the entire volume of net agricultural output, the net output of sovkhozes and kolkhozes is supplemented by the net output of private subsidiary farming. The latter can be calculated on the basis of the report "Composition of the Aggregate Income of the Families of Kolkhoz Members (Workers)." The given report is elaborated by republic TsSUs on the basis of budget studies of the population of all republic oblasts. Calculations show that while the share of output of private subsidiary farming in the net agricultural output of Gomel'skaya Oblast declined by more than 10 percent, it nonetheless remains very substantial (over 30 percent).

Turnover tax is the fourth important component element of net output. The calculation of turnover tax produced in the oblast is complicated by difficulties of an informational character. Turnover tax for union republics is calculated centrally by the USSR TsSU based on the volume of production of taxable output and is communicated to the TsSUs of union republics.

Only realized turnover tax, i. e., turnover tax on products realized within the oblast by industrial enterprises and wholesale organizations irrespective of the place of production can be calculated on the basis of the data of oblast finance organs. This has prompted some economists to conclude that turnover tax must be excluded from calculations of effectiveness of social production in order to avoid distortion.[4] This point of view seems to be incorrect since turnover tax is of a productive character and at the present time comprises a significant part of the country's net income.[5] In the Belorussian SSR, the share of turnover tax in republic national income was 9.4 percent in 1975. Consequently, indicators of regional effectiveness of social production and the level of economic development calculated on the basis of net output without turnover tax will be significantly understated and for a number of regions will also be significantly distorted.

The Branch Structure of Net Output With Turnover Tax in the BSSR and Gomel'skaya Oblast* (in %)

Branch	1972	1973	1974	1975	1975	1976	1976
	Gomel'skaya Oblast			BSSR	Gomel'skaya Oblast	BSSR	Gomel'skaya Oblast
Total for national economy...............	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Of which:							
industry..............	53.0	51.0	54.1	54.1	50.6	51.9	55.5
agriculture...........	26.6	28.7	24.9	21.7	23.5	20.5	22.9
construction	10.0	9.8	10.2	10.8	10.1	10.3	9.6
transport and communications (serving material production)**..........	3.8	4.0	4.0	4.1	4.2	4.2	4.2
Other branches of material production...........	6.6	6.5	6.8	12.8	7.3	13.1	7.8

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*The branch structure is determined on the basis of the evaluation of the volume of net output in comparable 1973 prices. Gross output conversion coefficients were used to convert the net output of branches of material production to comparable 1973 prices.

**The net output of transport and communications was calculated on the basis of the share of these branches of the economy in republic national income.

Pending the development of more precise methods for calculating regional volumes of turnover tax, it is possible and expedient to include realized turnover tax in calculations of net output at the oblast level.

The described method was used as the basis for the experimental calculation of the net output of Gomel'skaya Oblast in the basic branches of material production between 1972 and 1976 (see table).

The branch structures of the net output of the republic and the oblast are obviously very similar. In Gomel'skaya Oblast, the share of industry and agriculture is higher (in 1976 by 6 percent) while the share of other branches of material production is lower (by 5.9 percent). Almost 80 percent of the net product is created in oblast industry and agriculture.

The calculation of the oblast net product is of interest not only for the determination of the effectiveness of regional economies but also for the establishment of the share of the oblast in national income created by the republic. The calculations show that in 1976 Gomel'skaya Oblast produced 15.1 percent of the national income of the BSSR. Oblast industry accounted for 16.1 percent of the republic's net industrial output; 16 percent of its net agricultural output; 14.0 percent of its net construction output; 14.9 percent of its net transport and communications output; and 15.8 percent of the net output of all other branches of material production.

Thus, it can be said in conclusion that the statistical information presently available at the oblast level permits us to make enlarged calculations of the net output of the basic branches of material production. This work will be considerably facilitated by centralized calculations of normative net industrial output by statistical organs in accordance with the 12 July 1979 decree of the CPSU Central Committee and the USSR Council of Ministers.

FOOTNOTES

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2. A. M. Polyak, "Povysheniye effektivnosti ispol'zovaniya material'nykh resursov" [Making More Effective Use of Material Resources]. Moscow, "Ekonomika," 1978, pp 46-47.

3. V. F. Medvedev and T. P. Krylova, "Sovershenstvovaniye planirovaniya razvitiya khozyaystva oblasti v sisteme ekonomiki respubli" [Improving the Planning of the Oblast Economy as a Part of the Republic Economic System]. Minsk, 1975, p 33.

4. Ibid., p 37.

5. According to data in the literature, the share of turnover tax in the overall republic net output ranges between 16 and 29 percent (see V. M. Bakhrakh, N. I. Pereleshina, and L. Ye. Orlova, "The Evaluation of Regional Net Output," IZV. AN SSSR. SER. EKON., No 1, 1975, p 34.

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INTRODUCTION OF NEW TECHNOLOGY

DISCUSSIONS ON INTRODUCTION OF NEW TECHNOLOGY

Economic Incentives

Moscow IZVESTIYA AKADEMII NAUK SSSR--SERIYA EKONOMICHESKAYA in Russian
No 2, Mar-Apr 80 pp 15-22

[Article by R. I. Khabibi]

[Text] The article is devoted to aspects of further improvement of economic incentives for scientific-technical progress in the light of the decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Increasing the Impact of Economic Instruments on Production Efficiency and the Quality of Performance." Specific ways of ensuring the effectiveness of a number of measures outlined in the decree are examined. Practical proposals are advanced for improvement of recordkeeping and reporting.

The decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Increasing the Impact of Economic Instruments on Production Efficiency and the Quality of Performance" was adopted in July 1979. The set of measures envisaged by this decree is undoubtedly a potent means of mobilizing all the country's resources for increasing the efficiency of social production in every way. "The course of aiming at efficiency," it was noted at the November (1978) Plenum of the CPSU Central Committee, "is inseparable ... from speeding up scientific-technical progress."[1] That is why the decree attributes great importance to measures aimed at improving the planning and economic stimulation of scientific-technical progress. The principal task today is to define specific ways of carrying out these measures in practice.

In recent years the pace of applying advances of science and technology to production has stepped up considerably. For instance, the number of types of new products put into production by industry was twice as great in the Ninth Five-Year Plan as in the eighth, and the scale of application of new technology doubled. The pace of scientific-technical progress is also rising in the current 5-year period.

That aim is furthered to a considerable degree by the planned product quality control system introduced during the last 5-year period, which is aimed at punctual application of scientific-technical advances to production and at a planned rise of the technical-and-economic indicators of products produced. The founding principle of this system is subordination of the entire effort to update products to the requirement that the technical-and-economic indicators be raised to the level of the highest attainment of domestic and foreign technology. One of the principal tasks of this system is to put an end to the practice of violating this principle, which has not yet died out. "There are still products," it was emphasized at the 25th party congress, "which figure in reports as 'new products,' but which actually are new only with respect to the date of manufacture, but not with respect to their technical level."[2]

The figures which follow bear witness to the system's effectiveness. Whereas in 1975 12,000 product items earned the state Quality Emblem, the number in 1977 was 29,100 and in 1978 38,700. At the beginning of 1978 the state Quality Emblem had been awarded to 48,200 products, and at the outset of 1979--62,400.[3]

At the same time, there is still a great deal of unused potential in this area. For instance, the share of products in the superior-quality category exceeded 13 percent of the total volume of industrial production in 7 months of 1979. However, in the petroleum refining and petrochemical industries, in the electrical equipment industry, in instrumentmaking, in the motor vehicle industry and machinebuilding or animal husbandry and livestock feed production the share of products in the superior-quality category has reached 31-44 percent.[4]

The decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Increasing the Impact of Economic Instruments on Production Efficiency and the Quality of Performance" envisaged measures which considerably heightens the motivation of production associations and enterprises to produce products in the superior-quality category. The share of products in the superior-quality category is becoming one of the principal indicators used in planning and evaluating the results of the economic activity of production associations and enterprises, its role is being strengthened as a fund-regulating indicator, the maximum level of incentive supplements to the wholesale price for highly effective new industrial and technical products is increasing, and financial penalties for manufacturing outdated products are becoming more effective.

This set of measures will undoubtedly increase the demand of industry in the next few years for prototypes of highly effective new products to replace outdated products. To satisfy this demand it will be necessary to considerably augment the number of prototypes of new products created; this especially applies to prototypes of new equipment, since their number has been dropping in recent years. Whereas in the Eighth Five-Year Plan the average number of prototypes of new equipment created in a year was 4,300, in the Ninth Five-Year Plan it was 4,000, and in the 1976-1978 period--3,600.[5] If measures are not taken very soon to increase the number of prototypes of new equipment created per year, this could hold back the further rise in renewal of production in machinebuilding.

The lag of pilot and experimental facilities is to a certain degree holding back the rise in the number of prototypes of new equipment created. Even though the volume of capital investments assigned to construction of pilot facilities has increased in recent years, in many industries there is still an acute shortage of experimental production operations for manufacturing and testing prototypes of new products and for perfecting new manufacturing processes. For instance, in machine tool building, machinebuilding for light industry and the food industry, and a number of other industries the need for pilot facilities is at best being met at a level of 40 percent.[6]

As a result a sizable portion of mechanical developments wait years to be put in the form of metal and sometimes they become obsolete before that takes place. The practice of diverting pilot and experimental production facilities to the manufacture of series-manufactured products is especially intolerable in this context. To eradicate this practice it would be advisable to introduce special statistical reporting on the existence and use of pilot and experimental production facilities in all industries. To convert a portion of the very small enterprises to pilot operation for scientific research institutes and design bureaus would be an important contribution to expanding the pilot and experimental capability. Proposals have been repeatedly made for this change in the configuration of a number of very small enterprises.[7] Unfortunately, this issue has not been resolved as it should have been.

The lag of pilot and experimental facilities is only one of the reasons for the delays encountered by the technical innovation on its way to production. To a considerable extent these delays are also related to the fact that the plans of organizations responsible for various sections of that road are not adjusted to one another.

The decree of the CPSU Central Committee and USSR Council of Ministers makes radical changes in the planning of scientific-technical progress. It calls for universal application of the experience of the electrical equipment industry, which was acquired during a major economic experiment in this industry to organize start-to-finish planning and to the financing of development and industrial application of new technology. In the 10 years that that experiment was conducted, the time from exploratory research to putting the experimental product run into production was reduced by one-third, and the economic benefit of introducing new products increased almost tenfold.[8]

Start-to-finish planning and financing are aimed at ensuring uninterrupted movement of the scientific-technical innovation along the entire "science--engineering--production" chain, which consists of preproduction and production links. The preproduction links would include scientific research projects, mechanical development, manufacture, as well as the testing of the experimental prototype, and they would end with adoption of the decision for series production of the new technology. The production links (i.e., the process of putting the product into production) includes a large number of preparatory operations in production itself. They would include preparation of blueprints, preparation of production, and then adjustment of the production process. The work of these links ends only after production of the new product has been brought all the way up to design capacity.

By contrast with the preproduction links, the work of these links is as a rule the responsibility of enterprises manufacturing the new technology. The great amount of work and sizable additional costs which they involve make the process of organizing the production of new technology a lengthy one and substantially lower the indicators of the economic efficiency of the enterprise's activity. Even today it is the production link that is the limiting factor in the science--engineering--production chain.

The decree of the CPSU Central Committee and USSR Council of Ministers envisages a number of measures which improve considerably the economic conditions for the process of putting new products into production. A unified fund for development and technology is created in ministries and departments to finance both R&D and also organization of the production of new products, including higher costs in the first years of a new product's production.

In order to ensure the maximum return on these measures important changes are advisable in the very system of technical preparation of production, which is today lagging considerably behind present-day requirements. It is this lag that is one of the principal causes of the lengthy period required to put new technology into production. To be specific, the extremely large amount of preparatory work is a consequence of the low level of the system of technical preparation of production. Under present conditions the transition to organizing the production of new technology usually requires, for example, an extremely sizable amount of production tools, jigs and fixtures. The manufacture of the MAZ-500 truck required in its time the design and manufacture of more than 12,000 items of cutting tools and measuring instruments, attachments and jigs, dies, press molds and patterns.[9] And if the toolroom facility of the enterprise is inadequate, then the process of organizing production takes a long time.

Often to speed up the work of putting new products into production other enterprises will be called upon to provide assistance in manufacturing the gear, which, of course, diminishes their own opportunities to update their products. For instance, in organizing the series manufacture of the Khersonets-200 self-propelled corn-harvesting combine other plants of the industry were called upon to help the manufacturing plant, since more than

6,000 dies alone had to be manufactured. But even then the process of organizing production will presumably take a long time.[10]

The tremendous amount of tools, jigs and fixtures required today is related to the low level of standardization of machine assemblies and parts. At the present time only 18-20 percent of tools, jigs and fixtures are used again when the product is updated, while the rest are written off for metal scrap because of the low level of standardization. As a result more than half of the costs of putting new technology into production go for the design and manufacture of production tools, jigs and fixtures.[11]

The costs are considerably reduced if the level of standardization of machine assemblies and parts is increased. A further rise in the level of standardization (interchangeability) is envisaged in the current 5-year period. For instance, for freight cars it is rising to 85 percent and for excavators to 80 percent.[12] At the same time, this level will still not be high enough for certain products of machinebuilding. For instance, the planned rise is only to 50 percent for farm tractors and rolling mill equipment.[13]

For purposes of meeting targets for the rise in the level of standardization it is important that a prototype of new technology not be allowed to go into series production if it does not meet the established standards with respect to use of standard components. This procedure is in effect in the machinebuilding industry of the GDR, where a standard of 80 percent has been set on component standardization. Of course, for products based on a fundamentally new and original idea the standard is lowered.[14]

The experience of advanced enterprises in our country bears witness to what large opportunities are opened up by raising the level of component standardization. The Moscow Krasnyy Proletariy Machine Tool Plant, for example, has during the current 5-year period put into production machine tools in more than 40 modifications and versions instead of the three models manufactured in 1973. It managed to do this primarily because of a considerable rise in the level of standardization of machine tool parts. They took 460 parts of the basic model of the universal lathe as a base. In the modifications of the lathe they used between 425 and 460 of those parts, and as a consequence the overall level of component standardization exceeded 90 percent for a number of models.[15] As a result the plant, while having greatly expanded its list of products, has retained all the advantages of large-series moving-belt production of machine tools.

Incidentally, when production is organized in this way, it is not legitimate at all to determine the average size of the production series from the output of the models manufactured. After all, if the level of component standardization is high, then production is still done in large series even if the output of certain modifications of the base model is small. The decisive role is played here by the size of the production series of the standardized parts, since they comprise the bulk of the volume of production.

A high level of component standardization is the basis of the present-day type of production, which, while remaining large in scale, becomes at the same time flexible and capable of reacting quickly to changes in consumers' requirements and of putting into production the most recent advances of science and technology in a very short time. The Krasnyy Proletariy Plant can serve as an example of precisely this type of production. By 1977 the volume of its export deliveries had increased fourfold over 1973. The plant has become the world's largest exporter of machine tools; its products are being delivered to 70 countries.[16]

To ensure the necessary flexibility of production, not only is it necessary to raise the level of component standardization, but also to give up the present primitive practice whereby enterprises putting new technology into production themselves manufacture the needed tools, jigs and fixtures. The main thing that needs to be done to serve that purpose is to expand centralized production of standardized manufacturing tools, jigs and fixtures and to organize their rental on a larger scale. A large benefit can come in this case from requiring that the machine tools manufactured be accompanied by a set of additional devices and attachments that considerably expand their capabilities, which is an extensive practice among foreign firms. The production of fully equipped machine tools in our country is increasing, but not enough.

Of course, additional costs are involved in manufacturing the set of accessories for the machine tool. But they will be fully repaid by the higher efficiency of the fully equipped machine tools. However, the present procedure whereby the output of machine tools is planned in terms of units makes it more difficult to manufacture fully equipped machine tools, since manufacture of the necessary set of accessories for the machine tool ends up not being counted as part of the plan.

The proposal that the output of machine tools should be planned in value terms and that consumers not be appropriated machine tools in units, but the means of acquiring them, along with the set of accessories, seems fully justified in this context. "Allocating to consumers allowed amounts to acquire such-and-such groups of machine tools as listed in the nomenclature in value terms," A. Kostousov, USSR minister of machine tool and tool industry, has remarked, "will afford them the possibility of ordering the accessories to go with the machine tool, which will ensure a sizable increase in its productivity. It is objectively impossible to organize the production of fully equipped machine tools with the present practice of planning the output of machine tools and units."[17]

Along with planning the output of machine tools in value terms, it would be wise to plan the output of machine tools also in conventional units, whose size would be determined by the ratio between the productivity of a given fully equipped machine tool and the base model. This dual planning would create an incentive for furnishing accessories for machine tools that ensure maximum growth in the productivity of the machine tool per unit value of the accessories. The decree of the CPSU Central Committee and USSR Council of Ministers opens up broad opportunities for introduction of such indicators. In particular, USSR Gosplan has been ordered to join interested ministries and departments in making the necessary changes in 1979 and 1980 in the system of physical units of measurement of products produced on the basis of broad use of scientifically sound technical-and-economic indicators which make it possible to register the efficiency, quality and other performance characteristics of products.

Thus the measures envisaged by the decree of the CPSU Central Committee and USSR Council of Ministers will serve as a powerful impetus for speeding up the process of organizing an up-to-date system of technical preparation of production. The following elements would be included: high level of standardization of machine parts and assemblies and also standardization of manufacturing processes, well-equipped tool facilities, centralized production and rental of standardized manufacturing tools, jigs and fixtures. Only if all these elements are created will the process of putting new technology into production cease to be the limiting link in the science--engineering--production chain.

The procedure envisaged by the decree of the CPSU Central Committee and USSR Council of Ministers for reimbursing the costs of putting new technology into production from the unified fund for development of science and technology built up with deductions from profit is expected to neutralize the adverse effect of the process of putting new technology into production on the economic results of an enterprise's activity. Of course, it does not follow at all from the fact that the costs of putting new technology into production are being financially reimbursed that these costs ought not to be taken into account in evaluating the efficiency of the new technology. To ignore them would result in a substantial distortion of the actual level of its efficiency from the standpoint of the national economy.

In determining the economic efficiency of new technology, then, along with costs included in the production cost, it is also necessary to take into account the cost of organizing production covered from the unified fund for development of science and technology and not included in the production cost. Incidentally, the level of remuneration is calculated analogously: the sum total of bonuses paid from the material incentive fund and not included in the production cost is added to payments made from the wage fund which are included in the production cost.

We should not a peculiarity in charging the costs of organizing production to the product: it would be advisable to distribute these costs over the entire volume of production of the product on which they were spent, i.e., to the volume of production over the entire period of the product's manufacture, and not only over the period when it is being put into production. In other words, it is a peculiarity of these costs that the period in which they are made does not coincide with the period over which they are charged to the product.

This circumstance likens the costs of organizing production to capital outlays. The difference between them is that the latter should be charged to the product produced over the period in which the given equipment is in operation, while the former are charged to the output of the products upon which they were spent over the entire period of its manufacture. However, this peculiarity of the costs of organizing production is not always taken into account. For instance, according to present procedure costs related to putting new products into production which are not reimbursed from the fund for organizing the production of new technology are charged to expenditures against future periods and are subsequently included in the production cost of the product in portions over the allowed period (as a rule not more than 2 years) from the moment their series or large-scale manufacture begins.[18]

The period allowed by present procedure (as a rule not more than 2 years) is considerably less than the entire period of the product's manufacture; in machinebuilding, for example, the actual period over which a product is manufactured exceeds this time threefold or fourfold. As a result the level of outlays to organize production which are included in the production cost turn out to be extremely high in the first 2 years of the product's manufacture and unjustifiably low in the subsequent years of the actual period of manufacture.

Thus the transition to financing the cost of organizing production with the resources of the unified fund for development of science and technology necessitates that appropriate changes be made in the procedure for charging the costs, so that it will be possible to have a reliable evaluation of the efficiency of the new technology from the standpoint of the national economy. Moreover, changes also need to be made in financing the costs of organizing production with the enterprise's own fund in cases when they are not reimbursed with funds from the unified fund for development of science and technology. In these cases it is possible to use the present procedure, i.e., to charge the costs to expenditures against future periods and later to include them in the production cost by portions. But the period over which the costs are charged to the production cost should in our opinion be increased and adjusted to the anticipated period during which the given product will be manufactured.

The decree of the CPSU Central Committee and USSR Council of Ministers includes among the indicators to be assigned in 5-year plans of industrial ministries, associations and enterprises, along with a breakdown by years, the indicator of the economic benefit from performance of scientific and technical measures. In the practice of the statistical service this indicator is computed in the form of the total benefit, which includes not only the benefit obtained within the enterprise from use of the new technology, but also the benefit embodied in the technology produced and realized by enterprises consuming the product.

There is every justification for using this indicator, since this total benefit reflects the actual contribution the enterprise has made to raising the efficiency of social production, and it commensurates and links measures related to the production and the use of new technology.

Production should take full advantage of each of these sources of higher efficiency. For that reason to properly evaluate an enterprise's performance it is necessary that its report indicate not only the total benefit, but also its components. This is also important because the components of the total benefit differ essentially in the character of the indicators they represent.

Whereas the benefit from use of new technology within an enterprise is a realized benefit obtained during the period covered by the report, the benefit embodied in the new technology produced during the period covered by the report is a benefit yet to be realized. Since the manufacture of the technology and its application are separate in time, sometimes a quite long time, the total benefit embodied in all the technology produced during the period covered by the report is realized only partially during that period. Moreover, the total benefit actually realized may deviate upward or downward from the anticipated benefit assumed by the manufacturing enterprise as a function of operating conditions.

Thus, whereas the first component of the total benefit characterizes the opportunities for raising efficiency which have been realized, the second represents opportunities which to a considerable extent are yet to be realized, i.e., they are a kind of stock which has been built up and which provides for a rise of efficiency in the future.

It is especially necessary to record the components of the total benefit separately when the benefit is being determined for industries and for the industrial sector as a whole. The reason is that there is a double counting when the total benefits of enterprises are added: the benefit of the technology which was delivered by one industrial enterprise to another and has been put into operation in the period covered by the report will be counted twice: by the manufacturing enterprise and by the enterprise that is the consumer of the new technology. Within an industry a double counting occurs if these enterprises are in the same industry, and it occurs in the industrial sector if they are both industrial enterprises. The longer the period covered by the report, the larger the relative share of the double counting.

If we add up separately each component of the total benefit, then we can obtain additional information for more precise characterization of the impact of scientific-technical progress. To be specific, by adding up the first component for each enterprise, i.e., the benefit obtained from using the new technology within the enterprise, we will get the benefit realized from introduction of the new technology within the industrial sector without double counting. As a result of adding up the second component for each enterprise, i.e., the benefit embodied in the product manufactured during the period covered by the report, we will find the extent to which the industrial sector has built up a stock for raising production efficiency both in the industrial sector and also in other sectors of the economy to which the new technology will be delivered.

Thus these indicators, revealing the content of the total benefit, make it possible to discover and compare the most important factors in its dynamic behavior. Without them, that is, when we have only the indicator of the total benefit, the evaluation will not be complete enough.

Further, it is important to adjust this kind of recording of the efficiency of using technology, which now exists in the industrial sector, in all sectors of the economy. This will make it possible to determine the benefit realized from use of new technology not only within the industrial sector, but within the national economy as a whole.

In conclusion we need to stress that practical realization of all the measures outlined in the decree of the CPSU Central Committee and USSR Council of Ministers will make it possible to considerably raise the rates of scientific-technical progress in the country's economy and will ensure a very rapid movement of efficient technical innovations along the road from the idea to the machine.

FOOTNOTES

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4. EKONOMICHESKAYA GAZETA, No 34, 1979.

5. "Narodnoye khozyaystvo SSSR v 1978 g.," p 94.

6. PRAVDA, 21 May 1977.

7. VOPROSY EKONOMIKI, No 3, 1975, p 121.

8. PRAVDA, 5 September 1979.

9. VOPROSY EKONOMIKI, No 5, 1966, p 137.

10. PRAVDA, 25 October 1978.

11. PRAVDA, 19 April 1976.

12. EKONOMICHESKAYA GAZETA, No 2, 1977, p 12.

13. Ibid.

14. PRAVDA, 19 April 1976.

15. KOMMUNIST, No 8, 1978, p 49.

16. Ibid., p 51.

17. IZVESTIYA, No 63, 1979.

18. "Osnovnyye polozheniya po planirovaniyu, uchetu i kal'kulirovaniyu sebestoimosti produktsii na promyshlennykh predpriyatiyakh" [Basic Principles Governing the Planning, Accounting and Official Calculation of Production Cost at Industrial Enterprises], USSR Gosplan, USSR Ministry of Finance, USSR State Committee for Prices, and USSR Central Statistical Administration, Moscow, 1970, p 19.

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Use of New Methods of Financing

Moscow IZVESTIYA AKADEMII NAUK SSSR—SERIYA EKONOMICHESKAYA in Russian No 2, Mar-Apr 80 pp 23-29

[Article by V. V. Ambrosius]

[Text] The article examines aspects of the impact of improving the mechanism for management of the development of science and technology on acceleration of scientific-technical progress [NTP] on the basis of experience with the economic experiment to speed up NTP conducted in the various branches of the electrical equipment industry. It also proposes that a set of measures be carried out to strengthen economic instruments for speeding up NTP in connection with the decree of the CPSU Central Committee and USSR Council of Ministers dated 12 July 1979.

The attention of the party and government have been centered on the problems of scientific-technical progress in all stages of the evolution and development of socialism. In the present stage, in the context of advanced socialism, they have become especially relevant.

Speeding up rates of scientific-technical progress is a condition for raising the efficiency of social production and the main road toward its intensification. Faster rates of scientific-technical progress are in turn unthinkable without constant improvement of the economic mechanism.

The decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Increasing the Impact of Economic Instruments on Production Efficiency and the Quality of Performance," adopted on 12 July 1979, envisaged a set of measures directed toward improving the mechanism for management of the development of science and technology and toward strengthening economic instruments for speeding up scientific-technical progress.

Experiments to speed up scientific-technical progress conducted within the Ministry of Electrical Equipment Industry and a number of other industries were taken into account in the preparation and drafting of that decree (in the experiment the transition was made to the new system of planning, financing and economic stimulation of projects related to new technology on the part of scientific-research, project planning and design, and process engineering organizations, enterprises and associations of the ministries).

The essence of the experiment in the electrical equipment industry was to enhance the economic motivation of enterprises and scientific, design and process engineering organizations to speed up their efforts to create and put into production new technology with the highest efficiency. A number of measures were carried out during the experiment. The system for planning the creation and application of new technology was amended. Before the transition to the new system of planning scientific research and development (until 1969) the industrywide plan for development of science and technology represented a collection of several thousand topics from the plans of more than 100 scientific-technical organizations and new technology plans of more than 300 industrial enterprises. These plans were not sufficiently interrelated or mutually adjusted, so that the possibility of duplicate development projects was not eliminated. It was the organization that was planned, rather than the scientific research topic (development project). During the experiment scientific research, project planning and design, and process engineering organizations of the ministry were converted to the cost-accounting system of organizing projects to create, put into production and apply new technology on the basis of job orders (contracts). The job orders define the end results of the projects being planned, including the economic benefit to the national economy; those responsible for performance; dates for completion of the work in all stages--from research to application of the results to production; the necessary material resources; the sources and amounts of financing and material incentives. Revamping the system for planning the creation of new technology was combined with organizational changes and consolidation of the network of scientific research institutes and design bureaus.

It was also an important measure to reorganize the system for financing new technology. The need for this reorganization resulted from the comprehensive approach to planning and organizing efforts to develop science and technology. Up until the conversion to the new system financing came from four sources: budget appropriations, deductions to put new technology into operation, deductions for scientific research projects, and funds of customers made available under business contracts.

There were a number of unjustifiable restrictions. For example, it was not allowed to finance R&D with the resources of the fund for putting new technology into production, which created additional difficulties in conducting scientific research projects.

Since 1969 new technology has been financed in the electrical equipment industry from two sources: the unified fund for development of science and technology created in the ministries and funds from customers for performance of projects on a business contract basis.

We will give the figures on the financing of scientific research, project planning and design, and process engineering projects included in the plan for new technology covering the 1971-1976 period at the Tallin Electrical Equipment Plant imeni Kalinin (in thousands of rubles):

Source	1971	1972	1973	1974	1975	1976
From the unified fund	965.5	993	1,068	1,313.2	1,388.1	1,822.9
Under contracts with customers	352.1	487	496	346.0	327.0	286.9
Total	1,308.6	1,480	1,564	1,659.5	1,715.9	2,109.8

As we see, between 1971 and 1976 there was an increase in the financing of projects related to new technology.

Having a single source for financing new technology made it possible to concentrate resources on the most important lines of scientific-technical progress, to coordinate the work of institutes, design bureaus and plants more effectively, to establish closer relations of developers and manufacturers of new technology with the ministry, and to create the conditions for development of cost-accounting methods of managing scientific-technical progress.

The experience of the Ministry of Electrical Equipment Industry and a number of other ministries has shown that creation of this fund has had a constructive effect in terms of speeding up technical progress in the industry and has made scientific research more effective. In the Ministry of Electrical Equipment Industry the time required to develop new products and put them into production decreased between one-third and one-half during the years of the experiment. But even now there is still considerable potential within the industry for improving the system of financing R&D done by scientific research institutes and design bureaus; were it mobilized, this would make it possible to enhance considerably the impact of financial instruments on faster completion of developments and their faster application to production.

In accordance with the new decree the unified fund for development of science and technology, which is intended to finance outlays for scientific research purposes and to put new technology into production, will presumably take place quite soon in all industrial ministries.

An important measure related to this transition of ministries to the new system of planning, financing and economic stimulation of new technology projects is the introduction in them of systems of industrywide product quality certification.

Products which have gone through the certification procedure are put in one of three quality categories:

i. the superior category, which exceeds in its technical-and-economic parameters and the quality of manufacture the best Soviet and foreign scientific-technical advances or is on a par with them and is competitive on the world market;

ii. the first category, which corresponds in its technical-and-economic parameters and quality of manufacture to present-day requirements of the economy;

iii. the second category, which in its technical-and-economic parameters and quality of manufacture does not meet present-day requirements of the economy and should be modernized or withdrawn from production within the period allowed.

A single indicator of the technical-and-economic level of production of products and of their quality is being introduced into planning practice for the ministry, its main administrations and enterprises and associations on the basis of industrywide certification of product quality: the volume of production of products in the superior-quality category and their proportion of the total volume of production of marketed products.

The level of quality of products produced has become for all industrial ministries one of the principal indicators for evaluating their operational and business performance and the most important fund-regulating indicator. For example, at the Tallin Estoplast Plant (which manufactures lamps) the plan for production of products in the superior-quality category was 25-30 percent of the total volume of output. If the approved plan for output of products in the superior-quality category is overfulfilled by 1 percent, material incentive funds are increased 2.5 percent; they are reduced by 6 percent for a 1-percent underfulfillment of the plan.

The proportion of products in the superior-quality category has risen considerably as a result of these measures.

The topics touched upon above have been dealt with extensively in the new decree. For instance, the decree called for increasing the size of additions to wholesale prices for industrial and technical products which have been awarded the Quality Emblem, and deductions from wholesale prices for outdated products in the amount of 50 percent of the profit obtained from their sale. The same procedure has been established with respect to products which have not been certified within the allowed period.

The entire system of economic incentives for creating new technology and putting it into production is undergoing fundamental change.

Three economic incentive funds are being formed in scientific research institutes and design bureaus: the material incentive fund, the fund for social welfare and cultural programs and housing construction, and the fund for development of the organization. A material incentive fund to create new technology is being created at industrial enterprises. The sources for building up these funds at enterprises, scientific research institutes and design bureaus (except for the development fund) are as follows:

1) deductions from the profit formed at the enterprise by virtue of the actual reduction of production cost achieved as a result of applying new scientific and technical solutions developed and introduced by organizations and enterprises of the ministry (15 percent of the total saving);

2) deductions from additional profit in the form of the incentive premium applied to wholesale prices for new products in the superior-quality category (on the basis of a fixed scale as a function of the size of the economic benefit);

3) funds included in the estimated cost of scientific research and project planning and design projects (the amount of these funds is dependent upon the size of the economic benefit to the national economy obtained from performing the measures) and also up to 20 percent of the planned wage fund of workers employed on jobs whose economic efficiency cannot be determined.

Twenty percent of the total amount of the funds goes to the centralized bonus fund of the ministry, and the remainder is distributed between the enterprise and scientific organizations as a function of the amount of work done.

Thus economic stimulation of the development of science and technology and material worker incentives have been made directly dependent on the economic benefit to the national economy and the annual benefit of enterprises in the industry derived from the actual manufacture of new products and the application of new technology and progressive manufacturing methods in production.

An analysis of scientific and project planning and design organizations shows that this procedure guarantees a rise in production efficiency thanks to faster introduction of scientific-technical measures and improvement of product quality. The annual growth of the benefit to the national economy, for example, is higher than 20 percent in the electrical equipment industry. The growth rates of the total annual economic benefit of putting new technology into production and its application in the electrical equipment industry increased nearly fourfold in the years of the experiment and exceeded the growth rates of transfers to incentive funds. The average annual growth rates of products in the superior-quality category also exceeded fourfold the growth rates of the total volume of production in the industry.

The comprehensive approach has been used more and more in planning the development of science in recent years, especially in the 10th Five-Year Plan. Science is penetrating deeper and deeper into the process of social reproduction. It is becoming a full-fledged participant in the creation and reproduction of national resources in its own right. The interrelated complex of science--engineering--production figures not only as a subsystem of social production as a whole, but also as one of the basis forms of development of the sectors of the national economy and of improvement of the implements, subjects and methods of labor.

K. Marx, foreseeing the growth of the role of science in social production, emphasized that in future there must be a "transformation of the production process from the simple process of labor to a scientific process which would put the forces of nature at its service and compel them to serve human needs...."[1]

The planned character of the development of the socialist system of economic activity, which is based on public ownership of the means of production, creates conditions for the fullest utilization of the achievements of the scientific-technical revolution and for a faster development of the productive forces and a faster rise of production efficiency on that basis. But the enormous advantages inherent in the socialist mode of production are not realized automatically, but require a planned and systematic improvement of production relations, including the economic methods of managing the processes of the development of science and technology and using their advances in social production in accordance with the requirements of the economic laws of socialism.

Yet such questions as changing the technical level of production, realization of the advantages of scientific-technical progress in production, raising production efficiency and product quality are sometimes viewed in isolation and are not sufficiently linked to reproductive processes as a whole. The decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Increasing the Impact of Economic Instruments on Production Efficiency and the Quality of Performance" calls attention to such cases.

Compilation of plans for development of science and technology is a part of planning scientific-technical progress, since it is done through the system of indicators of all sections of the plan for development of the national economy. But this principle is not realized to the extent required by management of scientific-technical progress on the basis of the comprehensive approach.

The indicators of scientific-technical progress, which are scattered over all sections of the plan, do not furnish an idea of the final results and of efficiency from the standpoint of the national economy. Consequently it is difficult to exert active pressure on those indicators through the economic mechanism.

It is no accident that in systems for evaluation of performance and economic incentives mandatory indicators of scientific-technical progress end up in second place after the general economic indicators of the plan. Some economists see a certain logic in this, since scientific-technical progress is not an end in itself, but a means of solving economic and social problems. But if we concur in this, then we must acknowledge, first, that management of the national economy is possible on the basis of general economic indicators without exerting a specific effect on the factors of economic growth, including such a determining factor as scientific-technical progress, and second, that evaluation of the benefit of measures (outlays) for technical development is not absolutely necessary.

However, it was stated at the 25th CPSU Congress that it is indispensable to adopt an orientation toward the final results of the national economy and to improve the management of all factors that determine these results, to aim the plan, economic instruments, incentives and the entire system of management toward faster scientific-technical progress and higher efficiency of social production.

That is why it is important, in our opinion, to determine how best to effectively manage scientific-technical progress, what changes it is now time to make in planning and other elements of the economic mechanism whose accomplishment would make it possible to solve the problems of technical policy systemically and comprehensively. From the standpoint of the methodology of national economic planning it is advisable to examine the problems of a more integrated (not scattered among the sections) planning of the indicators of scientific-technical progress, the necessary resources and their efficient use.

The comprehensive nature of planning scientific-technical progress also presupposes that the NTP plan be linked to the other sections of general economic plans. Such indicators should reflect the following: a) support of the processes of creating, disseminating and applying new technology with all types of resources (manpower, materials, capital investments, plant capacities, and finances) with a full reckoning of costs; b) comparison of the costs and the benefits achieved, influence of those benefits on the general economic indicators in other sections of the plan; c) consideration of the social consequences of scientific-technical progress, including improvement of working conditions and making the environment more healthy.

NTP plans should reflect the methods and proportions of the stimulation of scientific-technical progress and data on improvement of management of scientific-technical progress as an integral element of the economic mechanism.

The leading components of unified sectorwide plans for scientific-technical progress would then be interrelated programs for the manufacture and application of the most important types of new technology, for creating systems of machines, putting them into production and disseminating them widely and for full mechanization and automation of production.

Unified plans and unified programs of scientific-technical progress ought to be linked at all levels with the comprehensive quality control system.[2] It is this comprehensive approach to plans, which are like a program in the way they are drafted, that makes it possible to adopt an orientation toward the final results of the national economy and accordingly to optimize proportions of the respective lines of technical progress and types of new technology. These correlations require that appropriate changes be made in the system of indicators of plans at all levels, including the technical, industrial and financial plan.[3]

Orientation toward the final results for the national economy is reflected in the computation of the indicator of the economic benefit to the national economy. The calculation is made by the method of determining the economic efficiency of using new technology, inventions and proposals of production innovators in the national economy. The term "benefit," as P. Bunich writes, has fundamental importance to comprehensive substantiation of the decisions made and to a precise accounting of what we are losing and what we are gaining.[4]

According to data of USSR Gosplan, 10 ministries were operating under the new system in 1977. As a result rates of scientific-technical progress have speeded up, the time required to apply scientific-technical advances has become shorter, there has been an increase in the output of products in the superior-quality category and in their proportion in the total volume of output, and the economic benefit to the national economy of putting new technology into production and applying it has increased.

For instance, at the Tallin Electrical Equipment Plant imeni M. I. Kalinin the economic benefit to the national economy from use of new products bearing the Quality Emblem increased from 14.55 million rubles in 1971 to 14,124 million rubles in 1977.

But conducting an economic experiment has its shortcomings. First of all, it takes at least several years to carry it out. Moreover, these are expensive measures requiring direct financial outlays. Approximately the same results might be given without an economic experiment by experimental computations made with specific numerical material, i.e., with the same economic entities, enterprises, industries, and regions where economic experiments are to be carried out, by means of experimental computations, which make it possible to analyze a sizable number of alternatives in the most diverse combinations. Moreover, experimental computations make it possible to do this research quickly and without large expenditures. Finally, an important advantage of this method of research is the possibility of eliminating outside factors not related to the experiment itself.

FOOTNOTES

1. Marx, K., and Engels, F., "Sochineniya" [Works], Vol 46, Part II, p 208.
2. Gatovskiy, L., "Strengthening the Orientation of Plans and Incentives Toward Highly Efficient Technology," VOPROSY EKONOMIKI, No 5, 1977, p 116.
3. Ibid.,
4. See Bunich, P., "Mekhanizm ekonomicheskogo stimulirovaniya pri sotsializme" [The Mechanism of Economic Incentives in the Socialist System], Moscow, Ekonomika, 1974, p 15.

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The Guaranteed Economic Benefit of R&D

Moscow IZVESTIYA AKADEMII NAUK SSSR--SERIYA EKONOMICHESKAYA in Russian
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[Article by L. L. Veger]

[Text] The article discusses the concept, economic content and nature of the guaranteed benefit of introduction of new technology under the conditions of continuing development of the new system of planning, stimulating and financing R&D. On the basis of an analysis of the character of research projects and a consideration of the development of cost-accounting relations between scientific research institutions and production enterprises the author proposes forms of economic penalties and incentives for obtaining the maximum possible benefit from R&D.

The term "guaranteed benefit," which made its appearance in connection with introduction of the new system of management of the electrical equipment industry, is becoming still more widespread as other sectors of the economy make the transition to that system. Further development of cost accounting and the use of job orders (contracts), envisaged by the decree of the CPSU

Central Committee and USSR Council of Ministers entitled "On Improving Planning and Increasing the Impact of Economic Instruments on Production Efficiency and the Quality of Performance," in industrywide scientific research and project planning and design organizations necessitates a more straightforward definition of this term, of methods of computing it, and of the conditions and prerequisites for its use and realization. It came into being under the impact of the requirements of material production on the one hand and the specific conditions of research and design activity on the other.

The need to speed up realization of scientific-technical advances is making it imperative that preparation of the production of new technology be started in good time, before the end of the particular stages of the R&D project.[1] The size of the economic benefit anticipated from the technology being developed, which is the basis for taking decisions on timely preparation of production and also on other matters, should be characterized by high accuracy, authenticity and reliability. Otherwise investments may result in losses and detract from the cost-accounting indicators of the enterprise organizing the production of new technology.

At the same time the anticipated benefit from the technology being developed, since it is calculated before R&D is entirely finished, is and will be an indicator based on probability to some degree. The probabilistic character of the anticipated benefit is manifested above all in the fact that the size of the anticipated benefit and the actual benefit do not coincide. On the average for a large number of development projects the size of the anticipated benefit exceeded the actual benefit by a factor of approximately 1.3.[2]

It was in this contradictory situation that the term "guaranteed benefit of R&D" made its appearance; it reconciles the requirement of the sphere of material production as to the authenticity of the initial data with the probabilistic nature of the indicator of the anticipated benefit.

Guaranteed benefit is an economic category applied in probabilistic economic processes, and it reflects the relations between parties to a contract (customer and developer) with respect to indeterminacy (in this case of the possibility of a deviation of the actual benefit from that anticipated). Use of the category of the guaranteed benefit in economic relations is aimed at stimulating workers and collectives developing new technology and putting it into production to maximize the actual benefit of its manufacture and use and to optimize expenditures of resources and time to develop it and to identify insoluble and ineffective topics.

In a practical sense the guaranteed benefit is an indicator of the economic benefit of introducing R&D, and it reflects the higher reliability whose achievement is guaranteed by specific economic measures protecting the manufacturer or consumer of the new technology against law suits (or failure to derive the benefit) occurring as a result of a discrepancy between the anticipated and actual benefit. In accordance with what we have said, the procedure for obtaining the guaranteed benefit, viewed as an integrated set of measures, should include the following: more precise forecasting of the technical-and-economic parameters of the future technology; a specific computation and adjustment of the size of the benefit; specific economic measures which make provision for compensation of losses or for additional incentives should the actual parameters of the new technology deviate from those anticipated.

In order to outline the methods of correcting and offsetting possible errors in computations of the anticipated benefit, we must discover their character and sources.[3] The causes giving rise to a discrepancy between the anticipated and actual benefit are diverse in nature, and therefore the methods of preventing them (of compensation) will also differ.

The principal explanation why the anticipated benefit is set high is the motivation of those doing the calculations and the developers. To the extent that the size of the economic benefit affects the size of incentives, the status afforded the topic, and so on, its developers, economists computing the benefit and other personnel on the scientific staff will be motivated to set the size of the benefit on the high side. This factor of motivation evidently accounts for a considerable portion of deviations making up the total overanticipation of the benefit.

Exaggeration (intentional) of the benefit is an undesirable phenomenon that could cause erroneous economic decisions. It can be eliminated by measures such as having the computations done by independent experts, establishing a separate status for economic staff services independent of scientific research institutes, involving the future consumers in the computations of the benefit, introducing a mechanism for monitoring an expert evaluation of the computations, etc.

For purpose of computing the guaranteed benefit provision is now made for customers (consumers) to ratify the benefit calculated by the developers. It is essential that this correction be based not on arbitrary subjective opinions, but on a critical analysis of those official data which are relevant to the consumer and which could exaggerate the importance of the benefit. They usually consist of optimistic estimates of the operating conditions of the future technology (setting the realistic amount of operating time too high), underestimation of waste, downtime, and rejects, failure to fully take into account the quality of the initial raw material and the regularity of its delivery, costs of repairing and servicing the new technology, and so on. The indicator of the future product's output is exaggerated with particular frequency. This figure should be cleared both with the consumer, who certifies that the need for the new product has not been exaggerated, and also with the manufacturer, who confirms that it is possible to manufacture the amount indicated in the anticipated year.

Scientific indeterminacy is still another factor in the discrepancy between the actual and anticipated benefit. It has to do with the fact that some of the total number of subproblems and various kinds of engineering problems may prove insoluble (or soluble, but not with the results which were anticipated) in the course of research and development of mechanical designs and processes. This means that a certain number of R&D projects will prove ineffective (and as a result will not be introduced) or less effective than anticipated. The larger the development's distance from the present level of science and technology, the greater the number of innovative elements in the technology being developed, and the earlier the stage of development in which the anticipated benefit is computed, the larger will be the number of such R&D projects and the greater the degree of reduction of the anticipated benefit.

Scientific indeterminacy is an inseparable feature of scientific-technical activity and results, first, from the need to work on new scientific-technical problems, and second, from the lack of a method of detecting (discriminating, identifying) the problems that can be solved and those which cannot. The errors (discrepancies), then, caused by this factor should be put among those which are objective and organically inherent in the anticipated benefit of R&D.

Attempts to eliminate the discrepancy between the anticipated and actual benefit caused by scientific indeterminacy lead to undesirable consequences and a lower effectiveness of development. For instance, to offer incentives for 100-percent application of development, for mandatory attainment of the anticipated (planned) benefit and other such measures would result in the disappearance from the scientific research topic plan of those fundamentally new problems which involve a risk, while there would be an increase in the share of topics which represent modernization of existing technology.

These factors--the specific exaggeration of benefit-causing factors and the risk related to scientific indeterminacy--result, as we have noted, in an exaggeration of the calculated (anticipated) benefit of the development.

The size (A) of this overestimation may be determined from statistical material, including data on the anticipated and actual benefit of a finite set of development projects previously completed, with this formula

$$A = \frac{\text{Э}^{0}_{\text{искл}} + \text{Э}^{0}_{\text{невн}} + \text{Э}^{0}_{\text{вн}}}{\text{Э}^{ф}_{\text{вн}}}, \tag{1}$$

in which $\text{Э}^{0}_{\text{ИСКЛ}}$, $\text{Э}^{0}_{\text{НЕВН}}$ and $\text{Э}^{0}_{\text{ВН}}$ are the benefit anticipated in the given stage from topics subsequently dropped from the project plan, not applied and applied, respectively, making up the population studied; $\text{Э}^{ф}_{\text{ВН}}$ is the actual (or potentially actual)[4] benefit of applying the development in that same population.

To compensate for this exaggeration the calculated anticipated benefit should be multiplied by the indicator (P) of the probability of its attainment (P = 1/A). The probability indicator in this case includes two components: the probability that a topic already begun will be applied (probability of success), and the probability that the anticipated benefit of the topic applied will not prove to be lower than the actual benefit. Approximate values of the indicator of the probability (P) of attaining the anticipated benefit are given in the table.

Coefficients for Offsetting Systematic Error in Computing the Anticipated Benefit (approximate data)

	Description of R&D Project			
Stage of Development Project After Which Benefit Was Calculated (adjusted, confirmed)	Product Modernization	Essential Changes in Design and Parameters of a Previous Product	Development of a New Design on Basis of a New Technology (approved)	Development of New Equipment for New Technology
Order of the customer, technical assignment, and technical proposal	0.60–0.80	0.50–0.70	0.40–0.65	0.30–0.55
Conceptual design	0.65–0.85	0.55–0.75	0.50–0.70	0.45–0.65
Technical design	0.80–0.95	0.70–0.90	0.60–0.80	0.55–0.75
Preparation of working documentation:				
a) of the experimental prototype (test run)	0.90–0.96	0.85–0.95	0.75–0.90	0.70–0.85
b) adjustment series	0.95–0.98	0.94–0.97	0.90–0.95	0.85–0.92
c) adjusted series or large-scale production	0.97–0.99	0.95–0.98	0.93–0.97	0.90–0.95
Series production, operation	1.0	1.0	1.0	1.0

In determining the probability indicator it is desirable to take other factors into account as well. For instance, if the anticipated benefit is calculated by an economist motivated to overestimate the benefit, the probability indicator should be taken at a level closer to its lower value. The same procedure should be followed in cases when the developer issuing the initial information for computation of the anticipated benefit is inclined to underestimate the complexity of the problem or to overestimate its significance or does not have sufficient experience. Higher values are taken for probability in cases when the anticipated benefit is determined objectively, when the data used in the calculation are provided by an experienced and competent developer or a developer inclined to overestimate the difficulties of the problem.

It is also desirable to take into account the effect of the time factor. In the period remaining before application of the new technology changes could occur in the industry being served which would diminish or even cancel its value (for example, a line developed at one time for processing Russian dandelion unexpectedly proved to be unnecessary, since at just that time synthetic rubber was obtained). The time factor can be taken into account by using a corrective coefficient equal to $(0.9\text{-}0.99)^{\tau}$ in which τ is the period of time from the moment when the calculation was made to the moment of operation. The lower value is taken for industries that depend on fashion, whose rate of technical renewal is rapid and which have frequent changes in conditions under which new technology is applied and operated.

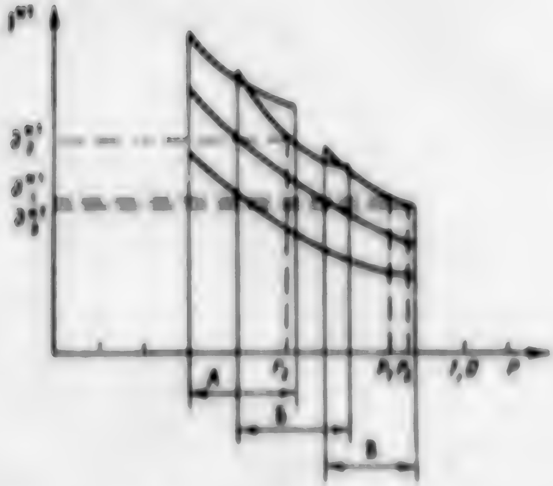
The annual benefit (Э), which makes provision for compensation of systematic error, should be calculated from this formula

$$Э = Э^{нт} \cdot P - З^{ниокр}, \qquad (2)$$

in which $Э^{НТ}$ is the anticipated economic benefit of the technology being developed, which is calculated in conformity with the "Method (Basic Principles) of Determining the Economic Efficiency of Utilization of New Technology, Inventions and Proposals of Production Innovators in the National Economy," on the basis of adjusted technical-and-economic indicators, and without taking into account preproduction costs, and adjusted for the time factor up to the period when it is anticipated that the benefit will be obtained; P is the indicator of the probability of attaining the calculated benefit (compensation for systematic error); $З^{НИОКР}$ are outlays for R&D (preproduction costs) adjusted for the time factor up to the same date as the benefit and adjusted to take into account a possible overestimation or underestimation of the size of the costs to be incurred.

The benefit determined with this formula approximates the actual benefit to the greatest degree attainable by means of adjustment. It therefore can be regarded as the calculated guaranteed benefit.

The size of the benefit ($Э^{НТ}$) and the probability of attaining it (P) are interdependent quantities (see the figure). One can predict, for example, a slight improvement of the technical-and-economic parameters (modernization) of existing technology promising a small benefit--$Э_1$, the probability of whose attainment will be very high--P_1, and one can plan a sizable improvement promising a large benefit--$Э_2$, but which has a lower probability of attainment--P_2. This functional relationship, which in turn is probabilistic in nature, lies in the fact that the greater the anticipated (planned) benefit of the given problem (type of technology), the lower the probability of its attainment, other conditions being equal.



Function showing dependence of the size of the anticipated benefit as a function of the problem to be solved ($Э^{нт}$) and the probability (P) of attaining it: A--zone of development embodying fundamentally new solutions; B--zone of development based on known principles; B--zone of modernization.

The existence of a functional relationship between the size of the benefit and the probability of attaining it makes it possible to furnish still another definition, one different from that previously given and another method of computing the guaranteed benefit of the technology being developed. It can be taken as the magnitude of the anticipated benefit which can be guaranteed with a certain previously given (by the superior agency or customer) probability (assumed, P_3 in the figure). Since there is such a conveniently high probability of attaining (or exceeding) this benefit, it corresponds fully to the concept of the guaranteed benefit.

But this approach, which guarantees reliability, does not satisfy the principal purpose of management--maximizing the actual benefit of new technology. The reason is that the guaranteed benefit calculated by this method will usually be very small ($Э_3$ in the figure). Moreover, the higher the demands as to degree of confidence, the smaller its size will be. But the requirement of a high guarantee of attainment of even a small benefit will orient staffs of scientists toward work on topics which do not involve a great risk (modernization, filling gaps in series of types and sizes, and so on). From the standpoint of the national economy it is more advantageous to require adherence to the optimum (for a given scientific problem and the collective's scientific potential) value of probability ensuring the maximum size of the benefit, determined in the form of its mathematical expectation (the product of the benefit by the probability of its attainment). As for a lower guarantee (probability) of attaining such a benefit and possible losses it involves, it is more advantageous to offset them by special economic measures.

The calculated guaranteed benefit, as defined in formula (2), will on the average coincide with the actual benefit, since the systematic error has been offset in it. But this coincidence, which would seem to give the basis for declaring it to be the guaranteed benefit, can be observed only in a sufficiently large population of R&D projects (in large industries or regions or over a lengthy period of time). With respect to each topic separately, its benefit calculated from formula (2), even though the systematic error is offset, will still not coincide with the actual benefit. The calculated guarateeed benefit is still subject to random errors, i.e., it will deviate both upward and downward from the actual benefit. Thus for altogether objective reasons the calculated guaranteed benefit remains a probabilistic category in which random deviations caused by these factors cannot be offset by computation, but necessitate specific economic measures. These measures, which represent the next stage in guaranteeing the benefit, pursue the ultimate goal of maximizing the actual benefit of the new technology created on the basis of the R&D project--and are oriented toward improving the stimulation and financing of its development and application.

The size of the deviation of the actual benefit from the anticipated benefit depends to some degree on the attitude toward the project of the researcher, the developer and other members of the scientific staff, as well as consumers of the new technology. If their attitude is one of positive motivation, they step up their activity, they look for unused potential to improve the parameters of the new technology, to save on costs, to shorten application time, and to optimize conditions of its operation. That is why the specific economic measures to guarantee the benefit should first of all pursue the task of motivating developers and consumers to maximize the anticipated and actual benefit of the new technology. This task is now being performed in that a part of the bonus is paid to the developer after the project is completed and on the basis of the actual benefit.

In our opinion this form would be made more effective if the advance bonus (upon completion of the key stages) were made on the basis of the size of the calculated guaranteed benefit, and the final computation should be used for a complete adjustment of the advance paid. For that purpose the size of bonuses for attainment of the actual benefit should be increased considerably, and if the benefit does not occur, economic penalties would be invoked in a number of cases (complete or partial withdrawal of the advance bonus paid for the topic in question, etc.). Provision could also be made for obtaining the full bonus or a larger bonus after the actual benefit is obtained (without paying a bonus in advance).

The economic measures should also pursue the goal of guaranteeing cost-accounting stability, i.e., the financial stability of the organization which is the developer and the enterprise which is the consumer in the situation where the anticipated benefit of the development remains a probabilistic category, i.e., for altogether objective reasons it may not be realized if the problem proves insoluble. In the system of centralized planning and budget financing of R&D the ministry (department) figures as the "guarantor" that possible losses will be covered. By accumulating the benefit (profit) from successful R&D projects, it builds up reserves from which it covers losses from other development projects. In this system scientific organizations receive only a portion of the benefit, but should the result be negative, they do not bear financial liability and do not return the funds expended. This type of guarantee, which ensures reimbursement of expenses and reproduction of scientific activity, i.e., the financial and organizational stability of operation of scientific staffs, does not sufficiently motivate them to do effective work.

That is why it seems advisable to take special steps to "guarantee" the benefit. In essence these measures constitute a development and intensification of cost-accounting relations between the scientific organization and the customer. They are expressed in the size of the payment for the scientific product (in its "price"), and also in the terms of financial settlements between them.

The most widespread form of settlement between the organization which is the developer and the customer was for a long time the system whereby the customer furnished advances to finance the organization which is the developer. In this system of settlement the customer pays for the project before it is completed, usually in parts as the various stages or phases are completed. Should the development be unsuccessful, the amounts paid are not ordinarily returned to the customer, and if the new technology proves to be more effective than anticipated, the bonus has not usually been increased, since it was limited to 20 percent of the wage fund, 2 months' salar-, etc. This form of settlement provides little incentive for the organization which is the developer to maximize the benefit of the technology being developed.

The economic measures to ensure the maximum possible benefit of new technology should make provision for greater cost-accounting responsibility for the actual effectiveness of the technology developed. These measures could on the one hand make provision for financial penalties should the development project be unsuccessful and the other for an increased incentive should the anticipated benefit be attained or exceeded. We will offer a number of possible forms of settlement (within the system of advance funding) arranged in order to relaxing the "rigidity" of the penalties.

1. Full guarantee of the organization which is the customer against possible losses. All the consequences of the risk (both favorable and unfavorable) are borne by the organization which is the developer. In case of failure the organization which is the developer returns the amount advanced (with interest), and he also reimburses other losses related to the unsuccessful nature of the development project (expenditures to prepare production, etc.). At the same time, should the development be successful, the organization performing the project should obtain a sizable portion of the benefit, i.e., the payment for the project (more accurately, for the result) should be relatively high. The larger amount of profit which the

organization which is the developer then obtains should be used for material incentives and also to replenish funds (insurance reserves) which is the specific source of covering losses on unsuccessful development projects.

II. Partial compensation of losses. In this system the parties to the contract would agree to divide equally (or in some other proportion) both the possible losses and also the possible benefit. The organization which is the developer would therefore return to the customer a specified portion of the amounts advanced should the topic be unsuccessful. In case of success their due portion of the benefit would be distributed between them in the specified proportion.

III. No guarantee (the present system). The organization which is the developer does not reimburse the customer for any losses, and in case of success he obtains over and above expenses a negligible portion of the benefit.

A promising form of payment for scientific-technical development is sale of the finished scientific-technical "product"--documentation, reports, etc. The benefit of completed work, since it is calculated from test data, is characterized by a relatively high reliability, and therefore the risk of incurring losses on the part of the consumer is very small. Taking into account that all expenditures and also the entire risk are in this case assumed by the organization which is the developer, who presents to the consumer only successfully completed developments which are ready for application, the developer must be afforded the largest possible portion of the benefit, and the "price" of the development must be at a maximum.

Proposals are frequently made for scientific organizations not only to reimburse the customer for losses, but also to cover the difference between the actual benefit and the guaranteed benefit (calculated, adjusted and brought into conformity with what we have previously said). This form of guarantee is the most rigid, and it will not apparently be effective, since it cannot be reinforced by an appropriate system of financing and incentives (the entire benefit or a sizable portion of it has to be assigned to the developer). Moreover, the size of the actual benefit depends not only on the developer, but also on the manufacturer and the consumer of the new technology, and therefore failure to derive the benefit may be a consequence of the technology's low quality of manufacture, poor operation, and so on. As a rule it has not been possible in such a case to discover what portion of the anticipated benefit is lost through the fault of the scientific organization. Therefore this form of guarantee seems unrealistic and unnecessary.

At the same time, if new technology is developed and manufactured by the same organization, its technical-and-economic parameters in operation could be guaranteed by developing supervision of installations, machine servicing, and so on. Since it is covering that portion of the benefit which is not derived from unsuccessful development projects, the organization must obtain a sizable portion of the benefit from models which exceed the given parameters. The wholesale price of new technology should in this case include a sizable portion of the benefit.

What we have said indicates that the guaranteed benefit--or, more accurately, the guaranteed anticipated benefit--can occur only under conditions of full-fledged cost accounting between the organization which is the developer and the organization which is the consumer (just as effective cost accounting is unthinkable without the economic measures indicated, which ensure financial liability and motivation of the scientific research institute concerning the effectiveness of its developments). It is therefore a necessary prerequisite to guaranteeing and in general maximizing the benefit of technology being developed to further develop cost accounting in relations between organizations figuring as developers and the consumers of their products.

In order to be able to do developments on their own account, delivering the finished product to the consumer, covering the customer's losses in advance financing, paying interest on credit, and having certain work done by subcontractors, scientific organizations have to be allocated adequate working capital of their own and other allocations, they must be able to carry out projects on the basis of credit obtained on the basis of the calculation of the guaranteed benefit, and they must be able to work on the problems which seem promising to them (though they may be underestimated by their customers or superior agencies), etc.

When scientific organizations are extended greater rights, they must also be made more accountable and given a greater incentive to work effectively. The financial status and material incentives of scientific staffs, as we have noted, should be related more closely to the actual efficiency of the technology they develop, and the probabilistic nature objectively inherent in scientific activity must be taken into account.

FOOTNOTES

1. The methods of computing the efficiency of timely preparation of production and also of the optimum degree of overlapping development and preparation of production are dealt with in EKONOMIKA I MATEMATICHESKIYE METODY, No 4, 1976.

2. Calculated from data in the following source: Pokrovskiy, V. A., "Povysheniye effektivnosti nauchnykh issledovaniy i razrabotok" [Increasing the Efficiency of R&D], Moscow, Ekonomika, 1978, p 66.

3. The article does not take up general methods of increasing the accuracy of calculations of the economic benefit--improvement and detailing of computational methods, increasing the completeness, reliability and accuracy of the initial data, and so on.

4. Since sometimes the actual benefit does not fully characterize the significance of the new technology to the national economy (lower volume of output, insufficient degree of utilization, etc.), for analytical purposes it is indispensable to use as well the indicator of the potentially actual benefit, which is calculated with respect to actual technical parameters of the new technology, but under optimum production and operating conditions.

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